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ABSTRACT

The study examined whether there were differences in the quality of classroom time spent by 79 mainstreamed learning disabled fifth grade students and 141 regular fifth grade students; and also whether differences in qualtiy of time related to student, instructional, and classroom variables. Trained observers coded learner moves, content area, and difficulty level on 5 minute cycles during math instruction with six students in each of 37 classes. Among findings were the following: over one third of the designated math period was devoted to nonmath activities; mainstreamed students tended to spend less time engaged in math activities than regular students in the same class; the key time variable distinguishing between mainstreamed and regular students was that regular students spent more time on tasks where they experienced success; instructors' interactions with students, either individually or in groups, influenced the amount of time engaged in math activities; and the introduction of handicapped students into regular classrooms was related to decreases in the engaged time of both mainstreamed and regular students. Over half the document consists of an appendix containing the complete observation training manual developed for the study and provides explanations of the observation categories and procedures for coding observations. (DB)

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Final Report
Grant No. G007902007

A Study of Academic Learning Time of Mainstreamed Handicapped Students

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S.H.L.C.
C.F.T.
S.R.T.
M.L.P.

I. INTRODUCTION

In a decade-ending issue of Phi Delta Kappan, Brodinsky (1979) recounted the ten most significant educational events of the seventies. Education of the handicapped was included in the list. No doubt this decision was based on passage of the Education of All Handicapped Children Act PL 94-142, which many consider the most significant legislation since the Elementary and Secondary Education Act (ESEA) of 1965. For FY79, federal assistance under PL 94-142 amounted to $804 million. For the state of California alone, $70 million was provided.

PL 94-142, which became fully in effect in September 1978, has broad implications for fiscal arrangements (Ballard & Zettel, 1978a); management functions (Ballard & Zettel, 1978b); due process (Ballard & Zettel, 1977; Goodman, 1976; Harvey, 1978); and instructional planning and programming of special, as well as regular, education programs (Abeson & Zettel, 1977). Key ingredients of PL 94-142 include: mandates for the provision of a free and appropriate education for all handicapped children in the least restrictive environment, use of non-discriminatory testing and evaluation procedures, development of individualized education programs, and adherence to procedural due process when decisions are made with regard to identification, evaluation, and placement of handicapped children.

The passage of PL 94-142 marked the end of what Abeson and Zettel (1977) called a "quiet revolution" which advocated the rights of handicapped children to a free and appropriate education. As a result of PL 94-142, schools are in violation of federal law if handicapped students are denied these rights. Furthermore, financial sanctions in the form of withdrawal of federal assistance to state, intermediate, and local educational agencies are applied to non-compliance

schools. With non-compliance schools, the U. S. Commissioner may also cut off funds for programs designed for the handicapped under: Part A of ESEA Title I, Part C of ESEA Title III and its successor, and the Vocational Educational Act.

Implementation of the letter and the spirit of the law has preoccupied special educators for the past few years. Like other large-scale social reforms, PL 94-142 has created tensions in the nation's schools. As schools gained experience in implementing the requirements of PL 94-142, numerous issues emerged. As an example, some of the language in the law and the regulations has been interpreted differently by agencies at the state and local levels. Several key ingredients of the law are particularly subject to different interpretations, such as: How should the least restrictive environment be defined? How do schools comply with requirements of I.E.P.? What constitutes "related services"? Staff development for educators has also become a major concern as regular teachers are increasingly being involved in the instruction of handicapped students and in the planning of that instruction. This increased involvement produces concomitant anxieties related to working with handicapped students (Roy Littlejohn & Associates, 1978; Shotel, Iano, & McGettigan, 1972; Todd & Laziar, 1980). Other implementation issues include: the selection and use of appropriate instruments and procedures to guarantee non-discriminatory assessment of students; working with parents to ensure fair hearings under the provisions of procedural safeguards; and documentation of child counts.

The Bureau of Education for the Handicapped (BEH--currently the Office of Special Education and Rehabilitation Services, under the new Department of Education) has been actively engaged in providing guidelines to clarify these implementation issues. In addition, BEH has funded studies to examine the progress being made under implementation of PL 94-142 (e.g., Educational Turnkey Systems, 1978; Management Analysis Center, 1977; Roy Littlejohn

Associates, 1978; Stanford Research Institute International, in progress; Stearns et al., 1977; Thomas Buffington & Associates, 1978). These studies have examined school administration and organizational arrangements and procedures that will affect success in implementing PL 94-142. The unit of analysis tends to be the school system at the local, intermediate, and state levels. Little is known yet about how handicapped students are performing in the classroom. That is, are handicapped students truly integrated into the mainstream of the regular classroom? The study described in this report is designed to contribute to an understanding of the in-class experiences of mainstreamed students, specifically the quality of time students spend in academic learning.

II. STUDY RATIONALE AND OBJECTIVES

For the last decade, there has been a fast growing body of research evidence indicating that direct instruction in specific academic areas and amount of time students spend in academic learning are positively related to student achievement in specific areas. In a recent review of major studies on teacher effectiveness, Rosenshine (1978) concluded that "direct instruction" leads to student achievement gains and that a high level of time on task is a major characteristic of such instruction.

A variety of studies indicate that the relationship between amount of time students spend on a specific area of school instruction and student achievement in that area is positive and in some cases relatively strong. As an example, Wiley and Harnischfeger (1974) examined the average number of hours of schooling students receive and found that variation by school was dramatically associated with acquisition of verbal and mathematical knowledge. In an extensive evaluation of 150 Follow-Through classrooms, Stallings (1975) obtained similar results. Three hundred forty correlations between reading achievement and classroom processes were conducted; 118 of these were significant at the .05 level. The variables most strongly correlated with reading achievement in both first and third grades were length of the school day and the average time a child spent engaged in reading activity. Studies conducted by Bond and Dykstra (1967), Harris and Serwer (1966), and Harris, Morrison, Serwer, and Gold (1968) all reported negative correlations between teacher or student absences and achievement.

In addition to examining the relationships of time in school as defined by attendance and hours of schooling to achievement, a number of investigators have related teacher estimates of opportunity to learn with student achievement (Borg, 1978; Chang & Raths, 1971; Comber & Keeves, 1973). Teacher estimates

are, however, rather crude measures of opportunity to learn. In his review, Borg (in press) concluded that studies using these measures "generally report positive relationships," although "many of these relationships are smaller than we may have expected" (p. 30).

Turning to the relationship between engaged time and student achievement, an extensive review by Bloom (1976) indicated relatively high positive correlations between engaged time and student achievement. Generally, these values range from 0.30 to 0.60. In his review of studies, Borg (in press) concluded that "although some correlations between achievement measures and on-task time are as high as .87, the majority are in the range from .30 to .50, thus accounting for from nine to twenty-five percent of the achievement variance" (p. 43).

Studies by Fisher and others over a four-year period with second- and fifth-grade students in reading and mathematics support the general premise that increased learning time leads to gains in achievement (Filby & Dishaw, 1976; Fisher et al., 1978; Marliave et al., 1977). Specific findings with respect to relationships between time and student achievement include:

- The amount of time that teachers allocate to instruction in a particular curriculum content area is positively associated with achievement in that content area.
- The proportion of allocated time that students are engaged is positively associated with achievement.
- The proportion of time that reading or mathematics tasks provide a high success rate for a student is positively associated with student achievement.
- The proportion of time that reading or mathematics tasks provide a low success rate for a student is negatively associated with student achievement.
- Increases in Academic Learning Time (ALT) are not associated with decreases in attitude towards mathematics, attitude toward reading, or attitude toward school.

Studies conducted by the ALT researchers differ in significant ways from previous studies. First, information on content was collected on highly specific operations. For example, in second-grade math, observations of content were conducted in nine topics: addition and subtraction with and without regrouping; computational transfer; place value and numerals; word problems; money; and measurement. Second, observation data were collected over two periods of time totally 23 weeks with over 250 students in second- and fifth-grade classes. Finally, detailed teacher logs were kept on a daily basis for each of the observed students. In short, the studies offers the most comprehensive information ever collected on the relationships between time variables and achievement.

All of the studies reported above deal with the time spent by regular students in school and/or in academic learning and the relationship between time and achievement. Research in this area that involves mainstreamed students is, as might be expected, far less comprehensive. There are, however, some studies. As an example, Gottlieb and Baker (1975) showed that the relationship between time integrated and social acceptance of educable mentally retarded (EMR) students in the regular classroom is quadradic as opposed to linear. The more time an EMR student is integrated in the regular classroom, the less likely he/she is socially accepted -- up to 65% of the total integrated time possible. When a EMR student is integrated more that 65% of the time, he/she is more likely to be viewed as "one of the group." With less than 65% of integration time, the EMR student is apparently viewed as an "intruder." With respect to subject areas where handicapped students are integrated into regular classes, Gottlieb and Baker found that of 300 EMR students who were integrated in regular classes, 86% had some time in non-academic subjects while only 33% and 41% had integrated time in reading and math, respectively. While these studies shed light on the amount

of integration time, the quality of time mainstreamed students are spending in regular classes remains to be investigated.

The specific objectives of this study are twofold:

1. To determine differences, if any, in the quality of time spent by mainstreamed students and regular students.

2. To relate differences in quality of time to student, instructional, and classroom variables.

Three outcomes were expected from the study. First, study findings would shed some light on the question "Are mainstreamed students truly integrated into regular classrooms?" Second, findings would further understandings of the dynamics of regular classes where handicapped students are mainstreamed. Third, some information would be generated on the feasibility of using quality of time as a dependent variable in future research and evaluation studies involving mainstreaming programs.

III. STUDY DESIGN

The conceptual basis of the study is derived from the Academic Learning Time (ALT) model of classroom learning and teaching (Berliner, 1977; Fisher et al., 1978). This model builds on the work of Carroll (1963), Bloom (1974, 1976), and Wiley and Harnischfeger (1974, 1976). It states that, for a given student, certain instructional processes lead to student classroom learning, which is then reflected in achievement test scores. In this model, student aptitudes have a direct impact on both student classroom learning and achievement test scores.

The important thing about this general model is that it distinguishes between student classroom learning and student achievement test scores. Achievement test scores are frequently used to measure learning. Test scores are one useful indicator of learning but they are not learning itself. Learning takes place over time in the mind of the student. The ALT model implies that learning can also be measured more directly and immediately by looking at student behavior in the classroom.

A measure of student classroom learning was developed using observable student behavior. This measure of student learning is called Academic Learning Time. Academic Learning Time is defined as the amount of time a student spends engaged in an academic task that the student can perform with high success. The more ALT a student accumulates, the more the student is learning.

The basic components of ALT are: allocated time, engaged time, and student success rate. Allocated time is the maximum time available for the student to work on a particular academic task. For some of the allocated time, the student will be actively engaged; that is, he/she will be paying attention to the academic

task. For some of the time, the student will be off-task, or unengaged. Since a student can only learn when he/she is paying attention, a measure of learning time should include only time when the student is engaged. Hence, engaged time represents a somewhat more refined measure of student classroom learning than allocated time. It includes that part of allocated time during which the student is paying attention.

The difficulty of the task for the student will also influence the amount learned. If the task is very difficult and the student produces few correct responses during the task, then the activity will not yield much learning for that student. On the other hand, if the student produces many correct responses on the task, then it is hypothesized that learning is occurring. Task difficulty for the student is measured in terms of student success rate. Success rate, as used in the ALT model, is a complex concept that warrants some elaboration. It is intended to reflect the degree to which the students correctly understand the instructional tasks they have been assigned. A given student will learn more from some tasks than from others. Hence there are degrees of task appropriateness for the student. Success rate is intended to reflect the appropriateness of the task for the student working on it. Three broad levels of success on a task were identified. High success describes situations where the student has a good grasp of the task and only makes occasional careless errors. If a student does not understand the task and makes correct responses at about the chance level, then this situation is labelled low success. Situations that fall between low and high success are defined as medium success. Medium success involves a situation of partial understanding, where the student understands enough to produce some correct responses, but also commits errors due to limitations in his/her understanding of the task.

The ALT model proposes that more time spent working with high success leads to increased achievement. However, this does not necessarily imply that all of a student's time should be spent in the high success condition. If all of a student's tasks are so easy that he/she is never challenged with new material, then little new learning is likely to occur. Generally it is expected that some balance between high and medium success tasks, with somewhat more activities at a high success level, will produce the most student learning. Low success tasks alone would always be detrimental to learning.

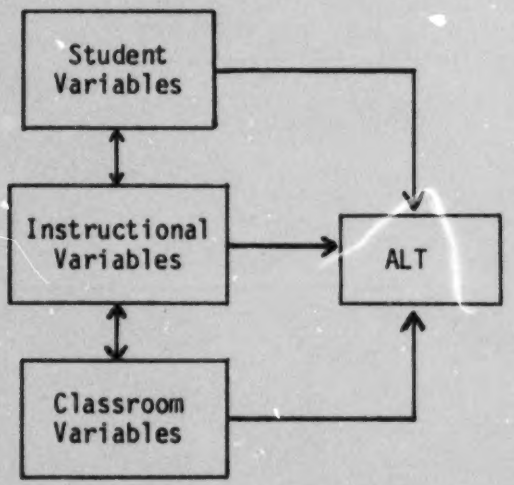
To summarize the ALT concept, time spent by a student engaged on a task that he/she can perform with high success and where the task is directly relevant to an academic outcome constitutes a measure of student classroom learning. Time spent under these conditions is referred to as Academic Learning Time. The basic components of ALT are allocated time, student engagement, and student success rate. The ALT model implies that the accumulation of Academic Learning Time will lead to gains in achievement.

In this study, the ALT concept was used in determining the differences between the quality of time spent by mainstreamed and regular students in academic learning. In addition, relationships were determined between differences in ALT and three types of variables: (1) student variables, (2) instructional variables, and (3) classroom variables. Relationships among these variables were also explored.

Figure 1 illustrates the study variables and their relationships. As the figure indicates, student, instructional, and classroom variables are viewed as important influences on ALT. Moreover, student and classroom variables are regarded as influences on instruction.

FIGURE 1

Relationship of ALT, Student, Instructional and Classroom Variables



Academic Learning Time includes the following variables:

- Allocated math time is the total amount of time devoted to math activities. It is computed by taking the total observed time and subtracting the time spent on non-math-related activities (i.e., transitions, management activities, breaks, other instruction, when students are absent).

- Engaged time is the total amount of time students are attending to or engaged in math activities (written, oral, or covert). It excludes those portions of allocated time in which the students were not attending to or engaged in math activities.

- Student success rate is the amount of time students are engaged in math tasks that are of three difficulty levels: (1) easy, (2) medium, or (3) hard. Easy tasks are those that students can with perform high success, i.e., where errors, except careless, are rare. Medium tasks are those that students can perform with some degree of success. Hard tasks are those that students cannot perform beyond a chance level of success.

Student variables include:

- Status (regular vs. mainstreamed).

- Math achievement is designated as below, at, or above grade level. Students who fell within a nine-month range of the school year in which a standardized math test was given were designated at grade level. Students who fell below that range were designated below grade level, and students who fell above that range were designated above grade level.

Instructional variables include instructor moves and the source and focus of those moves. These variables are:

- Explanations - where the instructor explains math instruction or activities.
- Academic feedback - where the instructor informs the student that a written answer or oral response is correct or incorrect.
- Academic questions - where the instructor asks the student to provide a written or oral response to a math problem.
- Structure/direct - where the instructor makes statements that direct the student to proceed with the process of math problem-solving.
- Positive feedback - where the instructor provides general positive statements about the quality of work or student effort.
- Negative feedback - where the instructor provides general negative statements about the quality of work or student effort.
- Source of instruction (i.e., teacher, other adult, curriculum materials, other student).
- Focus of instruction (i.e., group of students, individual target student).

Classroom variables include:

- Class size.
- Number of handicapped students in the class.
- Extra adult help in math class (i.e., classroom aides or parent volunteers present to assist the teacher).

During the course of the study, teachers' training in special education was also investigated. Their involvement in and perception of individualized education programs were additional topics of interest.

IV. SAMPLE

Recruitment of the sample began with the identification of districts within a 50-mile radius of San Francisco that had at least two years' experience in mainstreaming. Proximity to San Francisco was necessary so as to allow project staff to maintain close contact with participating schools. Experience with mainstreaming was felt to be important in that inexperienced sites undoubtedly face start-up difficulties. Selecting only experienced sites eliminated the possibility that outcomes of the study could be attributed to these difficulties.

The next step in the recruitment process was to obtain consent from superintendents and coordinators/directors of special education in the districts identified. Following district-level consent, the project staff distributed a one-page description of the study to all elementary principals in the consenting districts (see Appendix A). Meetings were scheduled with interested principals to further explain the intent and time requirements of the study. Each principal, in turn, presented the study to his/her faculty. In some cases, project staff were requested to explain the study to potential teacher participants. Those fifth-grade teachers who expressed interest in participating in the study and who had at least one mainstreamed learning disabled (LD) student in their class were then contacted, and a schedule of classroom observations was developed.

The final sample consisted of 37 fifth-grade teachers from 17 schools in 6 Bay Area districts. The mean class size was 28.6 students (S.D. = 6.1). The mean number of mainstreamed students in each class was 3.2 students (S.D. = 2.1). In approximately 40% of the classes, an aide or parent was present to assist the teacher during math period.

From each of the 37 classes, a total of six students were selected for the study. These students were either learning disabled or regular students. To

obtain the sample of six students, the following procedure was used. First, project staff examined student files by class and accepted all of the students in the class who were designated LD and who received math instruction from the regular teacher. For any given class, the number of LD students accepted ranged from one to four. The remaining two to five students were selected from teacher nominations. Teachers were told to nominate students who were performing at grade level in math. Using this procedure, the final student sample consisted of 220 fifth-graders: 79 mainstreamed LD students (36%) and 141 regular students (64%). On the average, each class of six students included two mainstreamed students and four regular students. The distribution of mainstreamed and regular students by district is displayed in Table 1.

The age range of the students was 10.2 years to 12.9 years. The mean age of mainstreamed students was higher than the mean age of regular students (11.4 years and 11.0 years, respectively).

TABLE 1

Distribution of Mainstreamed and Regular Students by Participating School District

District	Mainstreamed		Regular	
	Frequency	Percent	Frequency	Percent
A	24	30.5	64	45.4
B	22	27.8	14	9.9
C	15	19.0	9	6.4
D	8	10.1	10	7.1
E	8	10.1	40	28.4
F	2	2.5	4	2.8
Total	79	100.0	141	100.0

The distribution of students by sex is shown in Table 2. Of the mainstreamed students, approximately two-thirds were male. Of the regular students, the percentage of males and females was about equal (49.6% and 50.4%, respectively). In the general population of fifth-graders, there are also as many boys as girls.

TABLE 2

Distribution of Mainstreamed and Regular Students by Sex

Sex	Mainstreamed		Regular	
	Frequency	Percent	Frequency	Percent
Male	53	67.1	70	49.6
Female	26	32.9	71	50.4
Total	79	100.0	141	100.0

The ethnicity of the student sample is indicated in Table 3. As the table shows, the majority of both mainstreamed and regular students were white (68.4% and 64.6%, respectively). Approximately 22% of both student groups were black. The remainder of the mainstreamed students (9%) were Hispanic. Six percent of the regular students were Hispanic, 5% Asian, and 1% Native American.

TABLE 3

Distribution of Mainstreamed and Regular Students by Ethnicity

	Mainstreamed		Regular	
	Frequency	Percent	Frequency	Percent
White	54	68.4	91	64.6
Hispanic	7	8.9	9	6.5
Black	18	22.7	31	22.3
Asian	0	0	7	5.2
Native American	0	0	2	1.4
Total	79	100.0	141	100.0

In order to examine student math achievement, a grade level range on the total math score attained on school-administered standardized achievement tests (in most cases, the California Test of Basic Skills) was established. Students were grouped according to whether they were at, below, or above grade level at the time the achievement test was administered. If the grade equivalent (GE) score was within the nine months of the school year in which the test was taken, the student was "at grade level." If the score was below the range, the student was assigned to the "below grade level" category. If the score was above the range, the student was "above grade level." Based on this rather crude scale, math achievement was determined for mainstreamed and regular students. As indicated in Table 4, 53.2% of the mainstreamed students were below grade level compared to 9.9% of the regular students. Over 63% of the regular students were above grade level; only 15.2% of the mainstreamed students were in the above grade level category.

TABLE 4

Distribution of Mainstreamed and
Regular Students by Grade Level Range

Grade Level Range	Mainstreamed		Regular	
	Frequency	Percent	Frequency	Percent
Below Grade Level	42	53.2	14	9.9
At Grade Level	20	25.3	30	21.3
Above Grade Level	12	15.2	89	63.1
Missing Data	5	6.3	8	5.7
Total	79	100.0	141	100.0

V. DATA COLLECTION PROCEDURES

Data were gathered through three methods: (1) classroom observation, (2) teacher questionnaires, and (3) a review of student files. Each of these methods is briefly described below. Training of the individuals who collected classroom observation data is also discussed.

Classroom Observation

Observations were conducted in each of the 37 classrooms during math period once a week for five weeks. The day of the week in which observations were made was randomly selected. Occasionally, rescheduling was necessary as the result of changes in the school schedule, field trips, and illness of the teacher. No substitute teachers were observed. A field staff member observed in one to three classrooms per day, depending on the proximity of the classrooms and scheduled math times. Each observer collected data in an average of seven classrooms per week.

Observations in each classroom focused on the six students included in the sample and on their interactions with the instructor. Thus, information was gathered both on Academic Learning Time and the instructional variables described in Section III. Each student was observed for five minutes and his/her behavior recorded on the Classroom Observation Form (see Appendix B). After each of the six students had been observed and their behavior recorded, the process was repeated.

Throughout the study, paired observations were conducted to check for reliability on observation variables. A total of 17 paired observations were carried out. Every observer was paired with every other observer at least once. Pearson r coefficients were computed for each pair of observers to

determine interrater reliability. The median of these coefficients, for each variable observed, is reported in Table 5.

Observation data were checked on a weekly basis for errors and omissions. The data were then logged and filed. When all data were collected, they were prepared for processing and analysis. The data were checked again by field observers and the project staff prior to data processing.

TABLE 5

Interrater Reliability Coefficients (Pearson r)

Variable Observed	Median Interrater Reliability	Variable Observed	Median Interrater Reliability
Engaged	.85	Transition	.54
Not Engaged	.78	Break	1.00
Easy	.67	Management	1.00
Medium	.66	Other Instruction	1.00
Hard	.98	Source: Teacher	.72
Explanations	.78	Source: Other Adult	1.00
Academic Feedback	.50	Source: Curriculum	1.00
Academic Questions	.49	Source: Other Student	.45
Structure/Direct	.14	Focus: Group	.64
Positive Feedback	1.00	Focus: Target Student	.77
Negative Feedback	1.00		

Teacher Questionnaires

A teacher questionnaire (see Appendix C) was designed to gather information about participating teachers' training in special education, current classroom context, and experience with individualized education plans (I.E.P.'s). Questionnaires were distributed in meetings with individual teachers that were conducted prior to the beginning of classroom observations. At these meetings, a member of the project staff discussed study procedures, including completion of the questionnaire. Items on the questionnaire were explained, and the teacher was given an opportunity to raise questions and concerns. Teachers

either completed the questionnaire immediately and submitted to the project staff member or completed it later and mailed it to the Far West Laboratory. Completed questionnaires were received from all participating teachers.

The questionnaire, which included sentence completion items, Likert scale items, and open-ended items, was divided into three sections. The first section included questions about coursework and inservice training in special education and about the nature of assistance or training that was perceived to be of greatest value. Section two dealt with classroom context. Questions were asked regarding number of students in the class, extra adult help available during math, and the structure of the math period. The third section was devoted to assessing the awareness, involvement, and attitudes of teachers toward the individualized education plans of the mainstreamed students in their classroom.

Review of Student Files

Student files were reviewed by project staff members to gather information on student variables and on I.E.P.'s. Information on the age, sex, ethnicity, and achievement of regular and mainstreamed students was collected from student cumulative records. Information on the individualized education plans of mainstreamed students was obtained from special education records. All data were recorded on the Student File Information Form (see Appendix D).

Review of the I.E.P.'s was accomplished by rating each of the plans on 17 of the 50 marker events included in an I.E.P. audit form proposed by Stephens and Macy (1979). According to PL 94-142, each special education student must have a written instructional plan to serve as an outline for an educational delivery system. The delivery system includes eight basic components: problem identification, analysis, design of proposed educational program, written documentation,

preparation for implementation, involvement of personnel responsible for plan implementation, and monitor and review components. By using 17 of the 50 marker events proposed by Stephens and Macy, a notion of I.E.P. quality was obtained in terms of who was involved, how they were involved, and the nature of the plan's objectives.

Training of Classroom Observers

Training of the five individuals who collected classroom observation data for the study was conducted during a two-week session. Each of these individuals had teaching experience in the elementary grades and graduate training in education. In addition, three of the observers had extensive classroom observation experience, having served as classroom observers on the Beginning Teacher Evaluation Study (BTES). The training that these individuals received covered four areas: (1) overview of special education, (2) review of math content, (3) use of the classroom observation system, and (4) school liaison procedures.

The overview of special education was designed to familiarize observers with types of handicapping conditions they might encounter in the classroom and with issues involved in mainstreaming. Each observer was given a series of handouts on these topics. The issues raised in the readings were then discussed during the training session.

Training in mathematics content was conducted by a senior Far West Laboratory staff member who is a math curriculum specialist. Since the trainees would be observing classroom instruction and student behavior during math period, there was a need for them to be familiar with math curriculum content at the fifth-grade level and have the ability to quickly recognize and code various math tasks. Training consisted of reviewing definitions and examples of 11 math categories, coding math tasks from fifth-grade math texts and

worksheets, and discussing and resolving discrepancies in coding.

Training in classroom observation was provided by the project staff with assistance from personnel from the BTES study. Observers were trained using an manual developed by the BTES staff and adapted for the current study (see Appendix E). This manual included general procedures for observation and an explanation of observation categories. After a review and discussion of the procedures and categories, observers practiced their skills by coding two videotaped excerpts of classroom instruction. Results were compared across coders and differences resolved. Observers then went in pairs to two elementary schools in San Francisco to practice coding in actual classroom situations.

The final topic covered in the training session was school liaison procedures. The importance of establishing and maintaining rapport with participating principals and teachers was emphasized. In addition, a review of the objectives and general procedures of the study was provided so that observers would be able to answer any questions that teachers had about the research effort in which they were participating. An information sheet was also prepared for observers to hand out to school personnel who requested information about the study (see Appendix F).

VI. STUDY FINDINGS

Study findings are organized around three topics: (1) teacher training in special education, as well as their involvement in and perception of I.E.P.'s; (2) differences between mainstreamed and regular students on Academic Learning Time; and (3) relationships of ALT, student, instructional, and classroom variables.

Teacher Training in Special Education and Involvement in and Perception of I.E.P.'s

Since the passage of PL 94-142, there has been a growing concern for the training of regular teachers to work with mainstreamed handicapped students. Of the 37 teachers in the sample, 9 teachers or 24% had taken college courses in special education; 28 teachers or 76% had not. Of the same sample, teachers, 27 teachers or 73% had inservice courses in special education offered by school districts or the state department; 10 teachers or 27% did not have that experience.

Teachers were asked to assess the impact of their training by using a six-point Likert scale, ranging from no impact (1) to a great deal of impact (6). Seventy-three percent indicated small, negligible, or no impact from their training. Twenty-seven percent indicated fair, substantial, or great deal of impact.

Teachers were also asked to describe their involvement in the development of I.E.P's for mainstreamed students in their classes. Involvement is defined as: (1) awareness of the existence of I.E.P's, (2) participation in I.E.P. planning, (3) preparation of sections of I.E.P.'s, and (4) perceived accountability to carry out I.E.P.'s. Table 6 displays the findings.

TABLE 6

Teacher Involvement in I.E.P.'s

	Yes	No
Awareness	36 (97%)	1 (3%)
Participation	34 (92%)	3 (8%)
Preparation	12 (32%)	25 (68%)
Accountability	16 (43%)	21 (57%)

As the table indicates, almost all teachers were aware of the existence of I.E.P's and participated in their development. However, 32% actually prepared parts of I.E.P.'s and 43% felt accountable for implementation.

Teachers were also asked to rate the effects of I.E.P.'s on aspects of their teaching: classroom teaching, planning curriculum, coordinating services with others, individualizing instruction, specification of needed services, monitoring student progress, and accountability for students. A six-point Likert scale was used, ranging from no effect (1) to a great deal of effect (6). Table 7 shows the means and standard deviations of the teachers' ratings.

TABLE 7

Teachers' Ratings of Effects of I.E.P.'s
(1 = no effect; 6 = great deal of effect)

	Mean	S.D.
Classroom Teaching	3.0	1.4
Planning Curriculum	2.9	1.3
Coordinating Services	3.4	1.4
Individualizing Instruction	3.9	1.5
Specification of Services	3.6	1.7
Monitoring	3.6	1.5
Accountability	3.6	1.6

Individualizing instruction received the highest mean rating (3.9), and planning curriculum the lowest (2.9). There was a fairly large amount of variability among teachers on all of the ratings (S.D. approximately 1.5).

In summary, a majority of the teachers in the sample had some inservice training in special education. However, they generally did not find that training to be of great help in their teaching. Almost all teachers knew about I.E.P.'s and participated in the planning process. However, less than 50% felt accountable for the implementation of I.E.P's or participated in the preparation of I.E.P.'s. With respect to teachers' perception of the effects of I.E.P.'s on their teaching, there was fair amount of variability among teachers, with the average rating between small and fair amount of impact.

Differences Between Mainstreamed and Regular Students on Academic Learning Time

Correlation data between ALT variables and student status (mainstreamed vs. regular) are discussed in this section. In addition, the results of a regression analysis using student status as the dependent variable and ALT variables as independent variables are reported. These results indicate the relative weights or importance of ALT variables for explaining differences between mainstreamed and regular students. Finally, results from a two-way analysis of variance using ALT variables as dependent variables are summarized. This analysis was conducted to determine the main as well as interaction effects of math achievement and student status on ALT variables.

Correlation Data

Findings are reported below for each of the components of ALT: allocated time, engaged time, and time on tasks of three difficulty levels.

Allocated Time. Observed time during a math period includes time on math activities, as well as time spent on transitions between math activities, breaks, classroom management activities, instruction other than math, and times when an observed student is absent. Allocated time is that portion of observed time spent in math activities. For the student sample as a whole (N=220), 62.6% of observed math time was allocated time. The distribution, in minutes, of allocated math time, non-math time, and total observed time for mainstreamed and regular students over the five-week observation period is presented in Table 8.

TABLE 8

Distribution of Allocated Math Time, Non-Math Time, and Observed Math Time for Mainstreamed and Regular Students

Time Variables	Mainstreamed (N=79)			Regular (N=141)		
	Mean	S.D.	Percent	Mean	S.D.	Percent
Allocated Math Time	189.0	68.4	59.0	219.8	59.4	64.6
Non-Math Time	131.4	69.9	41.0	120.6	59.2	35.4
Observed Math Time	320.4	46.2	100.0	340.4	58.8	100.0

The mean of observed time per student was 320.4 minutes for mainstreamed students and 340.4 minutes for regular students. For mainstreamed students, the percent of allocated math time was 59.0% For regular students, the percent of allocated time was 64.6%. The relationship between student status (mainstreamed vs. regular) with allocated math time was statistically significant ($r = .18$, $t = 2.70$, $p = .01$).

Thus, there was a significant difference in favor of the regular students on the variable of allocated math time. In other words, mainstreamed students spent proportionately more time during math period on transitions, breaks, management, other instruction, or absences than regular students.

Engaged Time. Engaged time is the time students spent being attentive to or engaged in math activities. For a given amount of allocated time, engaged time is usually a portion of that allocated time. Table 9 displays engaged math time for mainstreamed and regular students.

TABLE 9

Distribution of Engaged Time in Math, Non-Engaged Time in Math, and Allocated Math Time for Mainstreamed and Regular Students

Time Variables	Mainstreamed(N=79)			Regular(N=141)		
	Mean	S.D.	Percent	Mean	S.D.	Percent
Engaged Time in Math	135.3	55.9	71.6	175.7	57.6	79.9
Non-Engaged Time in Math	53.7	36.4	28.4	44.1	33.4	20.1
Allocated Math Time	189.0	68.4	100.0	219.8	59.4	100.0

For mainstreamed students, the amount of engaged time as a percent of allocated math time was 71.6%. For regular students, the amount of engaged time as a percent of allocated time was 79.9%. The relationship of engaged time and student status was also significant (r = .19, t = 2.85, p = .01). In other words, mainstreamed students spent proportionately less time engaged in math activities than regular students.

Time on Tasks of Three Difficulty Levels. As noted earlier, observations were taken on the difficulty levels of math tasks. Levels of difficulty are expressed as easy (where students can perform with no or few careless errors), medium (where students can perform with some success), and hard (where students cannot perform with success). The distribution of student time on these tasks is shown in Table 10.

TABLE 10

Distribution of Time in Easy, Medium, and Hard Math Tasks for Mainstreamed and Regular Students

Time Variables	Mainstreamed (N=79)			Regular (N=141)		
	Mean	S.D.	Percent	Mean	S.D.	Percent
Time in Easy Math Tasks	29.7	52.5	15.7	80.7	72.5	36.7
Time in Medium Math Tasks	141.3	60.2	74.8	130.9	71.9	59.6
Time in Hard Math Tasks	18.0	29.3	9.5	8.2	18.5	3.7
Allocated Math Time	189.0	68.4	100.0	219.8	59.4	100.0

Mainstreamed students spent proportionately less time on easy tasks (15.7% vs. 36.7%) and proportionately more time on medium difficulty tasks (74.8% vs. 59.6%) and hard tasks (9.5% vs. 3.7%) than regular students. These differences were significant (easy: $r = .33$, $t = 5.16$, $p = .01$; medium: $r = .20$, $t = 3.01$, $p = .01$; hard: $r = .31$, $t = 4.81$, $p = .01$).

Figure 2 illustrates the allocated and engaged times of mainstreamed and regular students, using a hypothetical math period of 60 minutes. Allocated math time was substantially less than the designated math period for both groups. However, regular students had somewhat more allocated and engaged time than mainstreamed students.

Figure 3 indicates the time differences between mainstreamed and regular students on easy, medium, and hard tasks based on their respective allocated math times.

FIGURE 2

Allocated Time and Engaged Time for Mainstreamed and Regular Students During a Sixty-Minute Math Period

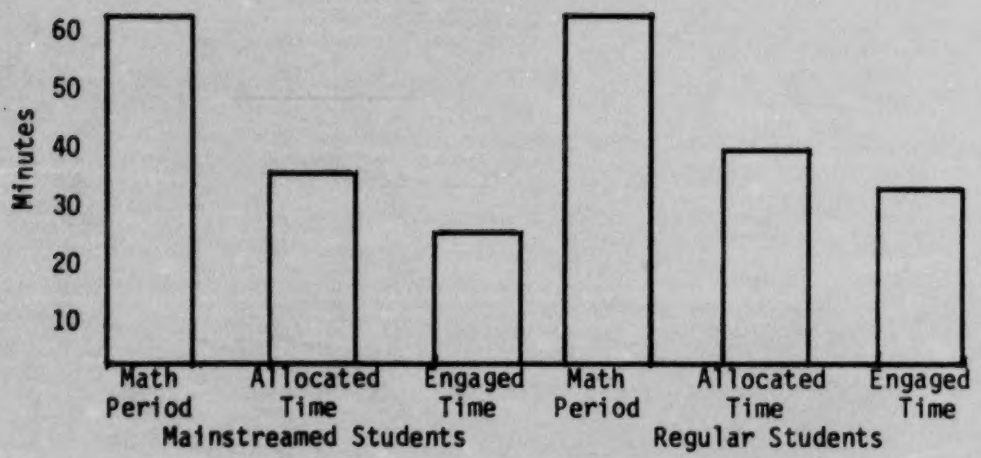
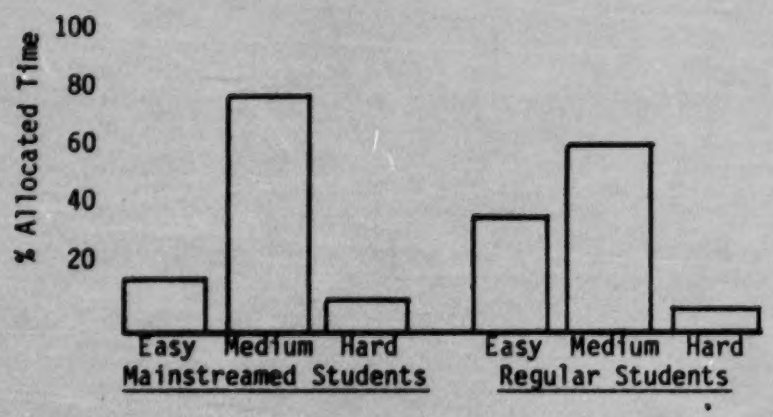


FIGURE 3

Time on Easy, Medium, and Hard Tasks for Mainstreamed and Regular Students



This figure illustrates the point that mainstreamed students spent proportionately less time on easy tasks than regular students. They also spent proportionately more time on medium and hard tasks than regular students. The majority of time for both groups was spent on medium difficulty tasks. Very little time was spent on hard tasks.

Results of Regression Analysis

Intercorrelations between student status (mainstreamed vs. regular) and ALT variables are shown in Table 11.

TABLE 11

Intercorrelations of Status and ALT Variables

	% Allocated Time	% Engaged Tasks	% Easy Tasks	% Medium Tasks	% Hard Tasks	Status
% Allocated Time	1.00					
% Engaged Time	-.125	1.00				
% Easy Tasks	.119	.221**	1.00			
% Medium Tasks	-.115	-.109	-.901**	1.00		
% Hard Tasks	-.021	-.235**	-.281**	.153	1.00	
Status	.179**	.191**	.328**	-.200**	-.308**	1.00

**p = .01

As the table indicates, student status was significantly correlated with all ALT variables. Regular students showed a higher percentage of allocated time, engaged time, and time on easy tasks than mainstreamed students. However, regular students showed lower percentages of time on medium tasks and hard tasks.

To further understand the differences between mainstreamed and regular students on ALT variables, a multiple linear regression procedure was employed. In this procedure, the relationship was examined between status (mainstreamed vs. regular) as the dependent variable, and four ALT variables (percent allocated time, percent engaged time, percent easy tasks, and percent medium tasks) as independent variables. Percent hard tasks was not entered into the regression equation, since this variable is "ipsative" with percent easy tasks and percent medium tasks. Table 12 shows the results of the regression analysis.

TABLE 12

Summary of Regression Analysis on Status

Variable Entered	Multiple R	r^2	RS Change
% Allocated Time	.179	.032	.032
% Engaged Time	.280	.078	.046
% Easy Tasks	.385	.148	.070
% Medium Tasks	.432	.186	.038

The table indicates that given this particular fixed order, which corresponds to the hierachical concept of ALT, 3.2% of the variance in status was explained by percent allocated time; an additional 4.6% was explained when percent engaged time was entered into the equation; another 7.0% was explained with the addition of percent time on easy tasks; and, finally, an additional 3.8% was explained with the inclusion of percent time on medium tasks. Clearly, percent time on easy tasks and percent time on medium tasks accounted for a large share of the variance between mainstreamed and regular students, while percent allocated time and percent engaged time accounted for a moderately large share of the variance between mainstreamed and regular students. Beta weights for the total 18.6% of the explained variance are as follows:

	Beta
% Allocated Time	.162
% Engaged Time	.107
% Easy Tasks	.698
% Medium Tasks	.460

These beta weights confirm the relative importance of time on easy tasks and medium tasks in explaining differences between mainstreamed and regular students.

Results of Two-Way ANOVA

From the descriptive data on math achievement presented earlier, it appears that status (mainstreamed vs. regular) is related to math achievement. For example, 53.2% of the mainstreamed students were below math grade level while only 9.9% of the mainstreamed students were below math grade level. The correlation between status and math achievement was moderately high. To further determine the significance of status and math achievement as they contribute to differences in ALT, a two-way analysis of variance was computed on ALT by status and math achievement. For this purpose, an index of ALT was constructed which combined the components of ALT as follows:

$$\text{ALT index} = \frac{\Sigma \text{ engaged time (\% time on easy tasks and \% time on medium tasks)}}{100}$$

Table 13 presents analysis of variance results, using this single index of ALT.

TABLE 13

Summary of Two-Way ANOVA

	Sum of Squares	DF	Mean Square	F	Significance
Main Effects					
Math Achievement	1.28	2	0.64	1.97	0.142
Status	4.86	1	4.86	14.98	0.001
Two-Way Interactions	2.35	2	1.19	3.63	0.028

From this analysis, it is evident that the main effect of status, was statistically significant ($p = .001$). The interaction effect of status and math achievement was also significant ($p = .05$). The main effect of math achievement on ALT was not statistically significant. In short, status was a more powerful determinant of differences in ALT, as operationalized, than math achievement. Put another way, although math achievement and status were moderately correlated ($r = .55$) and the interaction effect of achievement and

and status was significantly related to differences in ALT, math achievement alone did not explain differences in ALT.

The interaction effect of math achievement and status on the ALT index can be illustrated by examining the distribution of scores on the ALT index by math achievement group (below grade level, at grade level, and above grade level) and by status (mainstreamed vs. regular students). Table 14 shows the ALT index values by the three groups of math achievers and by status.

TABLE 14

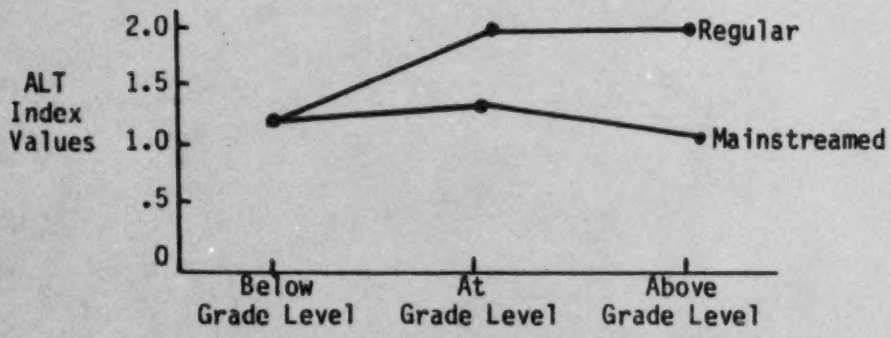
Distribution of ALT Index Values by Three Groups of Math Achievers and by Status

	Below Grade Level	At Grade Level	Above Grade Level
Mainstreamed	1.23	1.25	1.14
Regular	1.23	1.76	1.76

These ALT index values are plotted in Figure 4. As both the figure and Table 14 suggest, differences in math achievement did not significantly affect the ALT of mainstreamed students. ALt index values for mainstreamed students below, at, and above grade level were about the same. However, there were differences in the ALT index values of regular students in the three achievement groups. The ALT of regular students below grade level was considerably smaller than the ALT of regular students at and above grade level. It should also be noted the ALT of below-grade-level regular students was the same as the ALT for mainstreamed students below grade level.

FIGURE 4

Interaction of Math Achievement and
Status on ALT Index Values



Summary

Differences between mainstreamed and regular students on ALT components can be summarized as follows:

1. Differences between mainstreamed and regular students appeared in all three components of ALT (allocated time, engaged time, and time on tasks of three difficulty levels).

2. Mainstreamed students spent less allocated time on math activities than regular students within a single math period. In other words, they spent more time than regular students on non-math activities (transitions, breaks, management, etc.).

3. Mainstreamed students spent less engaged time in math tasks than regular students.

4. Mainstreamed students tended to spend more time than regular students on math tasks that were relatively more difficult.

5. Of the ALT variables, time on easy math tasks followed by time on medium difficulty math tasks were the most powerful contributing factors to differences between mainstreamed and regular students.

6. The differences in ALT between mainstreamed and regular students were not accounted for by differences in math achievement between groups.

Relationships of ALT, Student, Instructional, and Classroom Variables

The relationship of student variables to Academic Learning Time and to instructional variables is discussed in this section. The relationship between instructional variables and ALT is also described. Finally, the relationship of classroom variables to ALT and to instructional variables is summarized.

Student Variables

The relationship between student entering math achievement and ALT variables for mainstreamed and regular students is illustrated in Table 15. The relationship of math achievement and ALT is somewhat different for the two groups of students. For regular students, math achievement and two ALT variables were significantly correlated. Percent of time spent on easy task was positively correlated with achievement (r = .31), and percent of time spent on tasks of medium difficulty was negatively correlated (r = -.31). For mainstreamed students, no relationship between achievement and ALT appear significant.

TABLE 15

Relationship Between Student Achievement and ALT Variables for Mainstreamed and Regular Students

ALT Variables	Math Achievement Level	
	Mainstreamed (N=79)	Regular (N=141)
	r	r
% Allocated Time	-.02	.13
% Engaged Time	-.13	.17
% Easy Tasks	-.02	.31**
% Medium Tasks	.06	-.31**
% Hard Tasks	-.13	-.09

** p = .01

Table 16 indicates the relationship between student math achievement and instructional variables. These correlation data suggest that teacher and other instructors' behaviors were not significantly related to the entering math achievement of either mainstreamed or regular students. All r values are .11 or less. Thus, student entering math achievement did not appear to affect instructors in their in-class behavior of offering explanations, providing academic feedback, asking academic questions, structuring/directing instruction, and giving positive and negative feedback.

TABLE 16

Relationship Between Student Achievement and Instructional Variables for Mainstreamed and Regular Students

Instructional Variables	Math Achievement Level	
	Mainstreamed (N=79)	Regular (N=141)
	r	r
Explanations	-.03	.01
Academic Feedback	-.11	.08
Academic Questions	-.07	-.06
Structure/Direct	.10	.04
Positive Feedback	.02	-.09
Negative Feedback	.11	-.10

Instructional Variables

Instructional variables include: (1) instructional moves: explanations, academic feedback, academic questions, structure/direct, positive feedback, and negative feedback; (2) source of instruction: from teacher, other adult, other student, and curriculum materials; and (3) focus of instruction: individual target student or groups of students. Table 17 shows the distribution of allocated math time spent on instructional variables. For mainstreamed students, approximately 73 minutes of the 189 minutes of allocated math time was spent in interactions with the instructor (38.6%), as compared to slightly over 93 minutes for regular students (49.2%).

During the percentage of time spent on instructional interactions, mainstreamed and regular students had a similar distribution of percent of time in each instructor move category. For both groups, approximately 83% of the instructor moves were explanations, academic feedback, or academic questions. For each instructor move, both source and focus of that move were coded. The source of instruction for both mainstreamed and regular students appears to be predominantly the teacher (80.9% and 76.5%, respectively), followed by the curriculum (14.3% and 19.2%, respectively). The focus of instruction for both mainstreamed and regular students was usually group instruction (74.1% for mainstreamed students and 84% for regular students). Individual mainstreamed students were the focus of instruction about 26% of the time; individual regular students were the focus only 15.3% of that time.

Tables 18 and 19 display the relationship of instructional variables and ALT variables for mainstreamed and regular students, respectively. These data suggest that, for both groups, instructor more variables were more strongly related to engaged time than to any other ALT variables. For regular students, this relationship was particularly strong. Instructor explanations,

TABLE 17

Distribution of Allocated Time Spent on Instructional Variables by Mainstreamed and Regular Students

Instructional Variables	Mainstreamed (N=79)			Regular (N=141)		
	Mean	S.D.	Percent	Mean	S.D.	Percent
Instructor Moves:						
Explanations	17.4	13.6	23.8	24.9	18.2	26.7
Academic Feedback	25.4	19.9	34.8	30.9	19.8	33.2
Academic Questions	17.5	19.6	24.0	22.3	19.4	23.9
Structure/Direct	10.4	8.3	14.2	12.3	11.9	13.2
Positive Feedback	.5	1.7	0.7	.4	1.5	0.5
Negative Feedback	1.7	2.9	2.5	2.3	3.6	2.5
Total	72.9		100.0	93.1		100.0
Source: Teacher	59.0	34.3	80.9	71.2	37.3	76.5
Source: Other Adult	1.7	7.9	2.3	1.9	8.4	2.1
Source: Other Student	1.8	3.9	2.5	2.2	5.2	2.2
Source: Curriculum	10.4	14.0	14.3	17.8	18.5	19.2
Total	72.9		100.0	93.1		100.0
Focus: Target Student	18.9	14.9	25.9	14.3	12.9	15.3
Focus: Group	54.0	38.3	74.1	78.8	45.6	84.7
Total	72.9		100.0	93.1		100.0

TABLE 18

Relationships Between Instructional Variables and ALT Variables for Mainstreamed Students (N=79)

Instructional Variables	ALT Variables: % Allocated Time	% Engaged Time	% Easy Tasks	% Medium Tasks	% Hard Tasks
	r	r	r	r	r
Explanations	.13	.16	-.27*	.16	.12
Academic Feedback	.04	.23*	-.21*	.24*	-.04
Academic Questions	-.07	.07	.04	-.06	.02
Structure/Direct	-.01	.14	-.03	.06	-.06
Positive Feedback	.07	.04	.15	-.01	-.20*
Negative Feedback	.21*	-.44**	.14	-.15	.05
Source: Teacher	-.07	.19*	-.21*	.16	.04
Source: Other Adult	.10	-.05	-.16	.19*	-.09
Source: Curriculum	-.03	.28*	.05	-.01	-.05
Source: Other Student	-.06	-.22*	.03	-.10	.13
Focus: Group	-.11	.29**	-.20*	.17	.00
Focus: Target Student	.12	-.21*	.05	-.07	.04

*p = .05

**p = .01

TABLE 19

Relationship Between Instructional Variables and ALT Variables for Regular Students (N=141)

Instructional Variables	ALT Variables: % Allocated Time	% Engaged Time	% Easy Tasks	% Medium Tasks	% Hard Tasks
	r	r	r	r	r
Explanations	-.20*	.49**	-.04	.04	.05
Academic Feedback	-.16	.41**	.17	-.17	-.03
Academic Questions	.06	.15	.00	.01	.02
Structure/Direct	.04	.30**	-.04	.05	-.01
Positive Feedback	.07	.12	.20*	-.20*	-.02
Negative Feedback	.03	-.44**	-.12	.10	.11
Source: Teacher	-.04	.57**	-.07	.06	.07
Source: Other Adult	-.19*	.00	-.04	.07	-.08
Source: Curriculum	-.11	.29**	.23**	-.24**	.01
Source: Other Student	-.02	-.18	-.01	.03	-.08
Focus: Group	-.11	.57**	.08	-.07	-.02
Focus: Target Student	-.04	-.21*	-.10	.06	.15

*p = .05

**p = .01

academic feedback, structure/direct, and negative feedback were significantly correlated with engaged time (r = .49, .41, .30, and -.44, respectively). For mainstreamed students, two instructor move variables--academic feedback and negative feedback--were related significantly to time engaged in math activities (r = .23 and -.44, respectively). It is interesting to note that, for both mainstreamed and regular students, the correlation between negative feedback and engaged time was -.44.

Teacher and curriculum as sources of instruction were positively correlated with the engaged time of regular students (r = .57 and .29, respectively). This same relationship was also apparent for mainstreamed students (r = .19 and .28, respectively). For mainsteamed students, there was also a significant negative correlation between other students as the source of instruction and students' engaged time.

With respect to the focus of instruction (group or target student), group focus was significantly related to the engaged time of both mainstreamed and regular students (r =.29 and .57, respectively). Thus, engaged time increased when more instructional moves were focused on groups of students. Focus on individual target students was negatively related to the engaged time of mainstreamed and regular students (r = -.21 for both groups), suggesting that focusing on individuals reduces the engaged time of the total group.

Classroom Variables

Classroom variables include: class size, number of handicapped students in the class, and whether teachers had help in math class. Class size ranged from 16 to 55 students, with a class size mean of 28.6 and a standard deviation of 6.1. The number of handicapped students in the class ranged from one to eight, with a mean of 3.2 and a standard deviation of 2.1. Forty percent of the teachers had help in the classroom and the remaining 60% did not.

To discern the relationships of classroom variables with instructional and ALT variables, data was aggregated by class in order to have comparable units of analysis. Therefore, the findings reported in the following tables are based on a sample size of 37 classes.

Correlations between classroom variables and ALT variables for mainstreamed and regular students are shown in Tables 20 and 21, respectively. For mainstreamed students, class size was significantly related to only one ALT variable--engaged time (r = .29). For regular students, no relationships between class size and ALT variables were significant.

Number of handicapped students in the class was significantly related to the engaged time of both mainstreamed and regular students (r = -.30 and -.41, respectively). That is, the greater the number of handicapped students in the class, the less time mainstreamed and regular were engaged in math activities. For mainstreamed students, the number of handicapped students was positively related to time spent on easy tasks (r = .31).

Extra help in the classroom was negatively correlated with the time spent on easy tasks by both mainstreamed and regular students (r = -.28 and -.36, respectively). For regular students, extra help was also negatively correlated with engaged time (r = -.28). It was positively correlated with the time regular students spent on tasks of medium difficulty (r = .31).

Tables 22 and 23 illustrate the relationship between classroom variables and instructional variables for mainstreamed and regular students, respectively. As the tables indicate, class size was significantly related to only one instructor move variable--academic questions (r = .28 for mainstreamed students and r = .30 for regular students). That is, the larger the class, the more time the instructor spent in asking academic questions. There were no significant relationships between class size and the source of instruction.

TABLE 20

Relationship Between Classroom Variables and ALT Variables
for Mainstreamed Students in 37 Classes

Classroom Variables	ALT Variables: % Allocated Time	% Engaged Time	% Easy Tasks	% Medium Tasks	% Hard Tasks
	r	r	r	r	r
Class Size	-.14	.29*	.22	-.22	-.10
No. of Handicapped Students	.20	-.30*	.31*	-.25	-.14
Extra Adult Help in Math Class	-.02	-.07	-.28*	.15	.17

*p = .05 **p = .01

TABLE 21

Relationship Between Classroom Variables and ALT Variables
for Regular Students in 37 Classes

Classroom Variables	ALT Variables: % Allocated Time	% Engaged Time	% Easy Tasks	% Medium Tasks	% Hard Tasks
	r	r	r	r	r
Class Size	-.10	-.08	-.10	.07	.14
No. of Handicapped Students	.12	-.41*	.02	-.04	.11
Extra Adult Help in Math Class	-.25	-.28*	-.36*	.31*	.22

*p = .05 **p = .01

TABLE 22

Relationship Between Classroom Variables and Instructional Variables for Mainstreamed Students in 37 Classes

Instructional Variables	Classroom Variables: Class Size	No. of Handicapped Students	Extra Adult Help in Math Class
	r	r	r
Explanations	-.17	-.20	-.02
Academic Feedback	-.07	-.38*	-.11
Academic Questions	.28*	-.07	-.01
Structure/Direct	.05	.00	-.04
Positive Feedback	.02	.14	-.17
Negative Feedback	-.17	.20	-.02
Source: Teacher	.08	-.27	-.13
Source: Other Adult	-.01	.21	.30*
Source: Curriculum	.03	-.31*	-.10
Source: Other Student	-.03	.50**	.20
Focus: Group	.18	-.30*	.00
Focus: Target Student	.34*	.16	-.21

*p = .05

**p = .01

TABLE 23

Relationship Between Classroom Variables and Instructional Variables for Regular Students in 37 Classes

Instructional Variables	Classroom Variables: Class Size	No. of Handicapped Students	Extra Adult Help in Math Class
	r	r	r
Explanations	.03	-.36*	-.04
Academic Feedback	.00	-.41*	-.14
Academic Questions	.30*	.00	.08
Structure/Direct	-.03	-.27	.28*
Positive Feedback	.08	.01	-.14
Negative Feedback	.22	.33*	.24
Source: Teacher	.16	.43**	-.02
Source: Other Adult	.26	.30*	-.29*
Source: Curriculum	.03	-.25	-.07
Source: Other Student	-.25	-.09	.02
Focus: Group	.10	-.42**	.05
Focus: Target Student	.25	.33*	-.06

*p = .05

**p = .01

For mainstreamed students, a significant relationship was found between class size and students as the focus of instruction (r = .34).

Number of handicapped students was more strongly related to instructor moves than class size. For both mainstreamed and regular students, number of handicapped was negatively correlated with academic feedback (r = -.38 and -.41, respectively). For regular students, two additional relationships were significant. Number of handicapped was negatively correlated with explanations (r = -.36) and positively correlated with negative feedback (r = .33).

With respect to source of instruction, several significant relationships were evident. For mainstreamed students, number of handicapped was positively correlated with other students as the instructional source (r = .50) and negatively related to the curriculum (r =-.31). For regular students, number of handicapped was positively related to two sources of instruction--the teacher (r =.43) and other adults (r = .30).

Number of handicapped was negatively related to the group as the instructional focus for both mainstreamed and regular students (r = -.30 and -.42, respectively). In other words, the more handicapped students in the classroom, the less likelihood that instruction was directed toward groups of students.

As might be predicted, extra help in the classroom was significantly related to other adults as the source of instruction for both mainstreamed and regular students (r = .30 and .29, respectively). The only other significant relationship was between extra help and the amount of time instructors spent in structuring/directing instruction for regular students (r = .28).

Summary

Relationships of ALT, student, instructional, and classroom variables are summarized as follows:

- Entering math achievement of regular students was significantly correlated with ALT. The greater the achievement level of students, the more time they spent on easy tasks and the less time spent on harder tasks. Entering math achievement of mainstreamed students was not significantly related to ALT.

- Entering math achievement was not significantly related to instructor behavior in the classroom for either mainstreamed or regular students.

- Somewhat less time was spent in instructor interactions with mainstreamed students than with regular students.

- For both mainstreamed and regular students, the source of classroom instruction was predominantly the teacher, and instruction was focused primarily on groups of students as opposed to individual students.

- For both mainstreamed and regular students, instructor interactions were positively related to engaged time. However, the relationship was stronger for regular students.

- Teacher and curriculum materials, as sources of instruction, were positively correlated with the engaged time of mainstreamed and regular students.

- The time spent in instuctor interactions with groups of students as opposed to individual students was positively related to the engaged time of mainstreamed and regular students.

- Mainstreamed students in larger classes showed moderately higher engaged time than mainstreamed students in smaller classes. Class size was not related to ALT variables for regular students.

- Class size was generally not related to instructional variables.

- Number of handicapped students in the class was significantly related to the engaged time of both mainstramed and regular students. As number of handicapped students increased, engaged time decreased for both groups.

- Number of handicapped students was significantly related to the academic feedback provided by the instructor to both mainstreamed and regular students. The greater the number of handicapped, the less time the instructor spent in providing academic feedback.

- Two relationships between number of handicapped and source of instruction were particularly strong. For mainstreamed students, instruction was more likely to be provided by other students as the number of handicapped increased. For regular students, an increase in the number of handicapped was associated with an increase in the likelihood that instruction was provided by the teacher.

- For both mainstreamed and regular students, the more handicapped in the classroom, the less the likelihood that instruction was directed toward groups of students.

- The presence of extra help in the classroom was negatively related to time spent on easy tasks by both regular and mainstreamed students. Regular students, in classes with extra help, also showed less engaged time.

VII. DISCUSSION

Study findings have implications for future research on the integration of handicapped students into regular classrooms. They also suggest ways in which instructional practices might be improved in mainstreamed classrooms.

In the classes observed in the study, over one-third of the designated math period was devoted to non-math activities (e.g., transitions, breaks, classroom management). Thus, there was a substantial loss of student opportunity to engage in the learning of academic skills. If this phenomenon occurs in other subject-matter areas, the total amount of opportunity loss is very substantial indeed. It appears that teachers, particularly those with mainstreamed students, need to be more aware of the use of time. In particular, they need to be skilled in managing and maximizing the time available for instruction.

Mainstreamed students in the study tended to spend less time engaged in math activities than regular students in the same class. This difference cannot be attributed entirely to achievement differences between groups. The key time variable that distinguishes between mainstreamed and regular students was the time spent on tasks where students experienced success. Mainstreamed students spent more time than regular students on tasks that were relatively more difficult for them and, therefore, less successful. It appears that spending more time on easier tasks with high degrees of success may be beneficial to mainstreamed students.

Instructional variables were related to the engaged time of both mainstreamed and regular students in the classes observed. More specifically, the instructors' interactions with students, either individually or in groups, influenced the amount of time engaged in math activities. Additional research

is needed to identify aspects of classroom instruction that are of particular importance in promoting students' learning time. Staff development efforts can then be designed to focus on critical aspects of instruction.

The introduction of handicapped students into regular classrooms was related to decreases in the engaged time of both mainstreamed and regular students. That is, as the number of handicapped students increased, engaged time decreased. It is obvious that regular teachers cannot accommodate large numbers of students with handicapping conditions of varying types and levels of severity. What must be determined through further research are the number and kinds of handicapped students who can be integrated effectively into regular classrooms.

In 40% of the classrooms included in the study, teaching aides or parent volunteers assisted the teacher during math period. The effects of extra assistance in the classroom were mixed. Research is needed to clarify the roles of classroom assistants and to determine their utility in improving instruction, particularly the instruction of mainstreamed students.

The study described in this report focused on students' Academic Learning Time in one elementary grade (grade 5) and one subject-matter area (math). Further studies of ALT are needed to determine differences between mainstreamed and regular students in other grades and subject-matter areas. In addition, a longitudinal study of the same students as they move from grade to grade could provide information on the stability or change of Academic Learning Time as a function of changes in teachers and classroom contexts.

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APPENDIX A:

DESCRIPTION OF STUDY

FAR WEST LABORATORY
FOR EDUCATIONAL RESEARCH AND DEVELOPMENT

A SPECIAL STUDY OF ACADEMIC LEARNING TIME

Under PL 94-142, schools are directed to provide a free and appropriate education for all handicapped students in the least restrictive environment. Many handicapped students are now being integrated in the regular class. The purpose of this study is to describe the quality of time mainstreamed students are spending in regular class instruction.

Study Objectives:

- To determine student engaged learning time between mainstreamed and regular students in mathematics.
- To relate classroom and teacher variables, e.g., size of instructional group, teacher feedback, to student engaged learning time.

Classroom Observation: 4-8 fifth grade students, both regular and mainstreamed, from each class will be observed during the math period for one observation day per week for a six-week period (January to February). Teacher need not prepare and teach anything special for those observation days. Observers will be as unobtrusive as possible so as not to disrupt classroom instruction.

Teacher Interview: Teachers whose students are observed will be asked to be interviewed once during the six-week period for approximately 15 minutes. Convenient time for the interview will be arranged (e.g., lunch hour, after school) between the teacher and the classroom observer.

Student Files: Student files at the principal's office will be examined at the building to record student achievement scores, sex, age, previous placement (if special class). No file will be removed from the premises. Convenient times for recording the information will be worked out with the principal and his/her staff.

Honorarium: Each teacher participating in the study will receive $80 honorarium for purchase of instructional materials or paying for special events for the class. Payments will be made in May or June, 1980.

Confidentiality: All data collected is treated as confidential. Schools, classes and students will be coded with identification numbers and all results will be reported as group data.

Study Results: At the end of the study, we will provide a group oral debriefing for all participating teachers on request. However, a copy of the study report will be made available to each building principal at the end of the study.

For further information, please contact:

Carol Rice or Susie Thum
(415) 565-3135

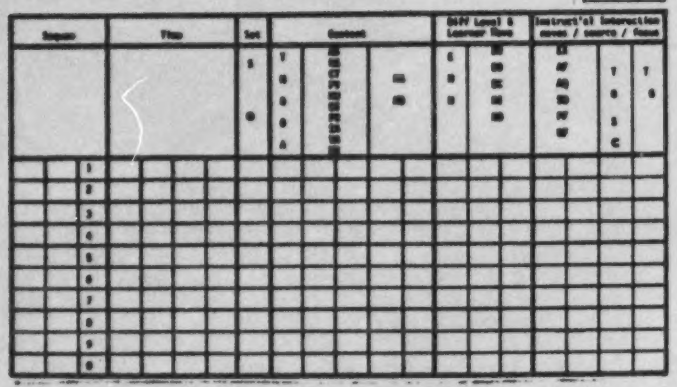
APPENDIX B:

CLASSROOM OBSERVATION FORM

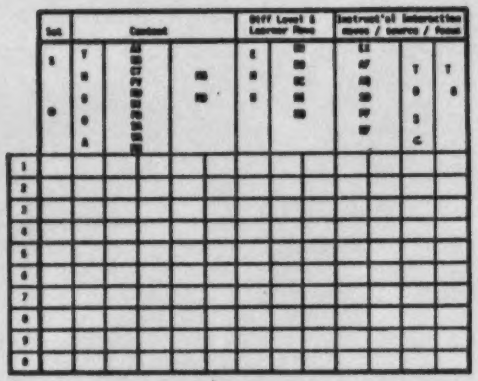
Classroom Observation Form

TEACHER ☐☐ GRADE ☐☐ OBSERVER ☐☐ DATE ☐☐ PAGE NO. ☐

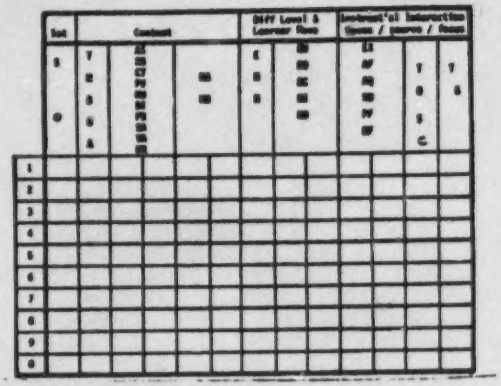
student ☐☐☐



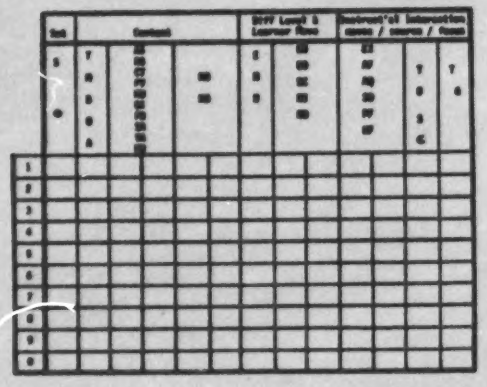
student ☐☐☐



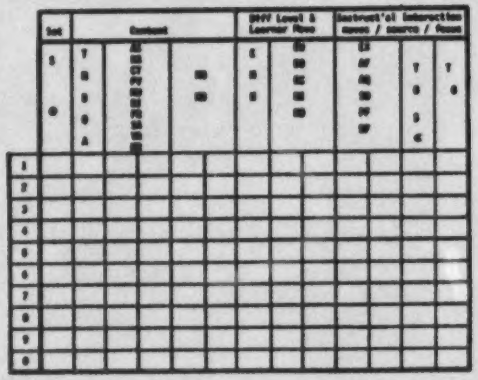
student ☐☐☐



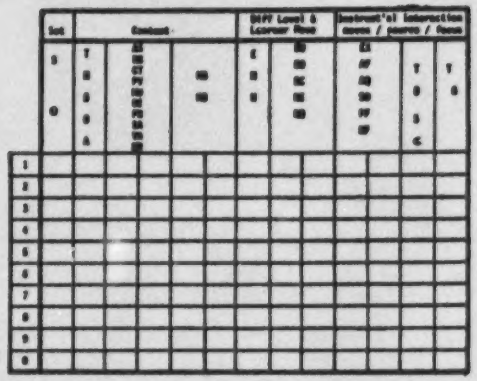
student ☐☐☐



student ☐☐☐



student ☐☐☐



APPENDIX C:

TEACHER QUESTIONNAIRE

TEACHER QUESTIONNAIRE

I. Teacher Demography & Training

1. Name: _____

2. Social Security No. _____

3. School: _____

4. District: _____

5. Number of years teaching experience: _____

6. Coursework in Special Education in the last five years:

   yes _____ no _____

Course Title	Year Taken
_____	_____
_____	_____
_____	_____

7. Inservice experience in Special Education in the last five years:

   yes _____ no _____

8. What impact has your previous inservice experiences had on your ability to work with the mainstreamed students you currently have in your classroom?

no impact at all	negligible amount	small amount	fair amount	substantial amount	great deal of impact

   Please explain _____

   _____

   _____

   _____

9. In order that you may work more effectively with the mainstreamed students you currently have in your classroom, what additional assistance would you like to have?

   _____

   _____

II. Classroom Context

1. Number of students in class: _____

2. Number of handicapped students in class: _____

   What handicapped conditions: _____

   _____

   _____

3. Number of adults in MATH class:

   teachers _____
   aides _____
   resource specialist _____
   parents _____
   curriculum consultant _____
   other _____ , please explain _____

   _____

   _____

4. Allocated math instruction times per day: _____ minutes

5. How do you normally structure the math period?

   _____

   _____

   _____

   _____

III. Individualized Educational Plan (IEP)

1. Are you aware that schools are required to develop IEP for individual students with learning difficulties/handicaps?

   yes _____ no _____ If yes, answer questions 2 and 3.

2. What is the extent of your involvement in developing the IEP for learning disabled/handicapped students in your class? Check as many as applicable.

   a. none ____
   b. was informed of existance of plan ____
   c. have reviewed plan ____
   d. attended planning meeting with principal, psychologist and others _____
   e. wrote sections of plan _____
   f. responsible for carrying out plan _____ please elaborate...

   _____

   _____

   _____

   g. other, please explain _____

   _____

   _____

   _____

3. To what extent has the IEP affected your daily classroom instruction for learning disabled/handicapped students in your class?

no impact at all	negligible amount	small amount	fair amount	substantial amount	great deal of impact

Please elaborate: _____

_____

_____

_____

4. Were you involved in:

a. making a referral _____

b. reviewing or developing achievement information _____

c. writing ancedotal records _____

d. meeting with the resource specialist or school psychologist _____

e. other planning meetings around this student _____

5. Has the I.E.P. effected or helped develop:

a. your ability to plan sequentially developed curriculum

no impact at all	negligible amount	small amount	fair amount	substantial amount	great deal of impact

b. the way in which the student program is coordinated

no impact at all	negligible amount	small amount	fair amount	substantial amount	great deal of impact

c. the amount of attention given to a student's individual needs

no impact at all	negligible amount	small amount	fair amount	substantial amount	great deal of impact

d. the specification of needed services, e.g., speech, pt, glasses, seating

no impact at all	negligible amount	small amount	fair amount	substantial amount	great deal of impact

e. a systematic way of monitoring progress of the identified students

no impact at all	negligible amount	small amount	fair amount	substantial amount	great deal of impact

f. your role in terms of accountability

no impact at all	negligible amount	small amount	fair amount	substantial amount	great deal of impact

APPENDIX D:

STUDENT FILE INFORMATION FORM

Student File Information

I. GENERAL INFORMATION

Name _____ I.D. ☐☐ Date _____

Teacher _____ I.D. ☐☐ Age ☐☐ yrs mos

School _____ Sex ☐

Grade _____ Ethnicity ☐

Handicapping condition _____

Previous placement _____ r.s. _____ s.d.c. _____ reg.cl.

Achievement score _____ sub score ☐ total _____ test _____ year

II. I.E.P. Audit

EVENT	CRITERIA	RATING
1. Determine Potential Areas for Programming Summary of diagnostic findings is included in I.E.P.	1 - No written summary 2 - Written summary is included but contains insufficient information for planning 3 - Written summary is included and contains adequate information for planning	☐
2. Specify Annual Goals One or more written annual goals are derived from specification of skills a pupil can be expected to attain in a specific curricular area within the school year.	1 - Non-delivery 2 - Informal statement of annual goals 3 - Annual goals are documented, but do not reflect consideration of pupil's present performance levels or of curricular areas 4 - Annual goals define curricular areas and expected direction of change 5 - Realistic annual goals reflect desired articulation with assessment data and with curricular areas	☐
3. Prioritize Annual Goals Annual goals are prioritized in terms of critical need areas which reflects consideration of student's age, remaining school years, amount of learning attained and pupil response to previous teaching methods.	1 - No prioritizing 2 - Annual goals are prioritized without consideration of pertinent variables 3 - Annual goals reflect consideration of critical need areas but order of priority questionable 4 - Annual goals reflect consideration of students performance level but neglect consideration of other critical variables 5 - Annual goals reflect valid prioritizing of critical need areas	☐

EVENT	CRITERIA	RATING
4. Specify Short Term Objectives Short term objectives serve as steps between child's present functioning level and goal child is expected to achieve by end of school year.	1 - Non-delivery 2 - Written record of one or more short term objectives for each annual goal 3 - Sequential listing of short term objectives to be achieved by pupil as he proceeds from present level of functioning to attainment of annual goal 4 - Realistic short term objectives are specifically stated in pupil terms, are measurable and observable and are valid link between present performance and annual goal	☐
5. Short Term Objectives Stated in Measurable Terms Short term objectives specify: (1) Observable skills, (2) person who is to exhibit skill, (3) conditions under which skill is to be achieved and (4) what constitutes achievement.	1 - No Specification 2 - Objective addresses one element 3 - Objective addresses two or more elements 4 - Objective addresses each of four elements	☐
6. Prioritize Short Term Objectives Short term objectives are prioritized in terms of critical need areas.	1 - No prioritizing 2 - Prioritizing does not address pertinent variables 3 - Prioritizing addresses some critical need areas 4 - Prioritizing addressed all critical need areas, but order of prioritizing questionable 5 - Short term objectives reflect valid prioritizing of critical need areas	☐
7. Lists Initial Instructional Activities Individually appropriate activities are listed which serve to implement specific short term objectives.	1 - No listing 2 - General suggestion of activity 3 - Activities clearly stated and contain valid skill sequences 4 - Clearly stated sequential activities start with pupil's present functional level and provide experience necessary for attainment of short term objectives	☐
8. Specification of Materials Required for Initial Activities Itemized list is prepared of materials needed in activities	1 - No listing 2 - Description of activity contains reference to materials 3 - Partial listing and description of materials 4 - Listing and description of materials required in activities designed to implement specific short term objectives	☐
9. Provide List of Support Services Needed for Goals/Objectives Support services (e.g., transportation, nutritional) required for implementation of goals and objectives are listed along with frequency of delivery and context in which they are to be provided.	1 - No listing 2 - Partial listing 3 - Complete listing 4 - Complete listing accompanied by schedule and conditions of delivery	☐
10. Required Participants Attend Meeting Held to Review IEP Meeting attended by an LEA representative, the child's teacher, parent or guardian, parent advocate or representative if requested by parent, and, when appropriate, the pupil for purpose of developing the pupil's individual educational program.	1 - No meeting held 2 - Meeting held without required participants 3 - All required participants attend 4 - Formally scheduled meeting attended by required persons and other professionals involved in developing the IEP	☐

EVENT	CRITERIA	RATING
11. IEP Committee Acceptance of Specific Services Required for IEP Listing is made of specific services required to implement pupil's IEP.	1 - No listing 2 - Listing incomplete 3 - Listing complete 4 - Compete listing is feasible 5 - Listing is completely feasible and acceptable to IEP Committee	☐
12. Placement Decision Made in IEP Review Meeting During IEP Review Meeting placement decision is made which reflects pupil's specific service needs and least restrictive environment.	1 - No placement statement 2 - No justification for placement decision 3 - Placement decision addresses only part of necessary components 4 - Placement decision addressed necessary components and is acceptable to participants at IEP meeting	☐
13. IEP Records Extent of Pupil's Participation in Regular Education Statement of extent to which pupil will participate in regular education addresses time, content, and peer group dimensions.	1 - No statement concerning participation in regular education 2 - General statement without dimensions 3 - Statement defines and addresses one or more dimensions 4 - Statement defines and addresses relevant dimensions	☐
14. Acceptance of Proposed IEP Following presentation, review (and possible revision of proposed IEP) each required participant at IEP planning meeting agrees in writing to its acceptance.	1 - No record of acceptance 2 - Record of acceptance by one or more participants 3 - Written acceptance of IEP by all participants	☐
15. Date Set for Service Initiation Following acceptance of the IEP by the required participants at the presentation meeting, a date shall be set for the initiation of services listed in the IEP and the LEA shall be responsible for its observance.	1 - No date set 2 - Initiation date set but services not specified 3 - Initiation date set and services specified 4 - Dates set, services specified and person assigned responsibility for initiation	☐
16. Statement of Anticipated Duration of Services Statement of the anticipated duration of all service listed in the IEP.	1 - No statement of anticipated duration of service 2 - Proposed duration date supplied for some some but not all services 3 - Rationale provided for duration date for all services	☐
17. Review and Modification of IEP Evaluation of progress in achievement of ST objectives and annual goals used as basis for review and revision of IEP.	1 - No review or modification 2 - Failure to achieve both review and modification 3 - Review and modification based on evaluation of progress in achievement of IEP goals and objectives	☐

APPENDIX E:

OBSERVATION TRAINING MANUAL

OBSERVATION TRAINING MANUAL

SPECIAL STUDY OF ACADEMIC LEARNING TIME

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OUTLINE OF OBSERVATION CATEGORIES

The following is a list of the observation categories to be used with very brief descriptions of each. This outline is to be used only for an initial overview and for quick reference. Complete explanations of these categories appear later in this manual.

General Content Categories

(General content includes periods other than math instruction. Any event that is coded in a general content category is not coded for any other categories, such as student and teacher behaviors.)

T = Transition
Transition refers to periods of change from one activity to another. This might include lining up, taking seats, or quieting down before the next activity. This includes periods of no activity that might occur when a student finishes his/her work early and no other activity is initiated.

M = Management
Management refers to the conduct of class business that is unrelated to any instructional activity. This includes such things as the collection or distribution of milk money and making arrangements for a field trip.

B = Break
Break includes any recreational or free period, such as recess, unstructured P.E., lunch, milk breaks, and leaving class to use the restroom.

O = Other instruction
Other instruction refers to academic and non-academic instruction other than mathematics (i.e., reading, science, flag salutes, etc.)

A = Absent, student is absent.

Mathematics Content Categories

AS = Addition and Subtraction with no regrouping, using the standard short form.

RG = Regrouping, addition and subtraction using the standard short form.

CT = Computational Transfer

PV = Place Value
Place value includes addition and subtraction without or with regrouping where an instructional algorithm involving a place value transformation is used.

MU = Multiplication

DI = Division

FR = Fractions

SA = Spatial Application
Spatial application includes geometry, measurement, and graphing without word problems.

VA = Verbal Application
Verbal application includes word problems.

MR = Mathematics Related
Mathematics related includes other mathematics content that is at or above the level of the tests to be used. Decimals would be coded MR.

MB = Mathematics, Below grade level
Mathematics below grade level includes other mathematics content that is developmental in nature. Activities such as learning to count up to ten would be coded MB.

Setting Categories

S = Self-paced
Self-paced includes activities where the student works at his own pace (such as seatwork).

O = Other-paced
Other-paced includes activities where the stuent must work at the pace of other students (such as group activities).

Difficulty Level Categories

E = Easy
Easy includes review and practice. Few errors are made and little effort is required of the student.

M = Medium
Medium difficulty includes any activities between "easy" and "hard".

H = Hard
Hard includes those activities that the student cannot carry out. Many errors and few correct responses (about what you would expect by chance) occur.

Learner Moves (Learner moves coded must be those of the target student being sampled.)

EW = Engaged, Written response

EO = Engaged, Oral response (statement or question)

EC = Engaged, Covert response
Engaged, Covert responses include any student response that is generally not observable. This includes most activities where the student is simply thinking, such as listening to the teacher or reading directions silently.

NI = Not engaged, Interim activity
Not engaged, interim activity refers to the nonacademic interim tasks that are part of a mathematics task. This includes sharpening pencils, turning in and passing out papers, getting books, and waiting for help.

NO = Not engaged, Off-task
Not engaged, off-task refers to periods where the student is inappropriately disengaged from a mathematics task. This would include socializing, daydreaming, and misbehavior during a mathematics task.

Instructor Moves

(An instructor move is coded only if it is received by the target student and is therefore relevant to the behavior coded for the target student at that moment. For example, if the student continues to work on a mathematics assignment while the teacher gives instructions to get out a reading text, then the student engagement in mathematics is coded, with no instructor move for that student.)

AF = Academic Feedback
Academic feedback refers to the teacher informing the student that a written or oral response was correct or incorrect. Any explanation is more than academic feedback.

AQ = Academic Question
An academic question consists of the teacher asking the student for a written or oral answer.

EX = Explanation
Explanation refers to instructional explanation provided to the student to satisfy a clear and immediate student need for help or provided according to previous plans for the instructor. This would include lectures.

SD = Structure or Direct
As with the other instructor moves, this move must be relevant to the mathematics task coded at the same moment. Structure or direct refers to statements of goals or objectives and the provision of instructions or directions.

PF = Task engagement feedback, Positive
Task engagement feedback, positive refers to the instructor's moves to praise appropriate behavior, such as good work habits. However, appropriate student behavior does not refer, here, to correct responses to a mathematics task. Teacher feedback for these responses would, as discussed above, be coded AF.

NF = Task engagement feedback, Negative
Task engagement feedback, negative refers to the instructor's moves to control inappropriate student behavior, such as off task behavior. In appropriate behavior here does not refer to incorrect responses to a math task. Teacher feedback for these responses would be coded AF.

Source of Instructor Move

T = Teacher
Teacher refers, here, to the instructor in charge of the class unit in which the observation takes place. This might be a mathematics specialist during the student's mathematics laboratory period.

O = Other adult
Other adult refers to an instructor who is not in charge of the class unit. This might be an aide or parent volunteer.

S = Student
Student is coded as the source of instruction when the target student is receiving instructional assistance (usually tutoring) from another student.

C = Curriculum
Curriculum is coded as the source of instruction when answers provided in the curriculum materials are used by the student to obtain academic feedback. Therefore, the source code, C, is used only with the instructor move, AF.

Focus of Instructor Move

T = Target
The target student is the focus of the instructor move only when that move is directed specifically to that individual target student.

G = Group
A group is the focus of the instructor move when the target student of the moment is in a group (two or more) that receives an instructor move. The group is coded when the instructor move is directed to the group as a whole or to some student in the group other than the target student (so long as the move is relevant to the target student).

OVERVIEW OF THE OBSERVATION SYSTEM

Model of classroom learning. The purpose of this observation system is to provide a description of some fundamental instructional events, with the intention of demonstrating a relationship between these events and student learning. The observation system is based upon a model of classroom learning that is centered on the student. This model suggests that the relationship between activities carried out by a teacher and learning attained by a student can only be understood in terms of student behaviors. This is due to the fact that the immediate cause of student learning must be student behaviors, not the activities of the teacher. Therefore, the teacher's activities can only influence student learning indirectly, through the intermediate student behaviors.

Studies of teaching have often attempted to relate teaching activities directly to student learning. Observation has been conducted to measure teacher activities and tests have been administered to measure student learning. Usually it is assumed that the teacher's activities are distributed equally among all students in a class. In addition, it is generally assumed that a given activity is equally appropriate for each student in the class.

The observation system to be explained here is designed to describe a teacher's activities in terms of the particular student or students to whom those activities pertain. For example, rather than simply describing how often a teacher asks questions of students in general, this system describes how often the teacher asks questions of a given student. More importantly, the system also describes what that student is doing at the time of the teacher's question. Using this system, it is possible to examine the

appropriateness of the teacher's question in terms of the ongoing student behavior to which it is related. In addition, it is possible to examine the effects of questions in terms of changes in student behavior that occur later.

One of the most important features of the observation is the determination of when a student behavior involves an activity (or a task) that is relevant to the learning of mathematics. In addition, when the student activity is relevant to mathematics, the observer must identify the particular subcategory of mathematics to which the activity is most related.

A second domain of student behavior is the intensity with which the student is involved (or engaged) in a given activity. This can range from a highly intense concentration on the activity, to the complete absence of mental involvement in a designated activity. The procedures of this manual require only that the observer distinguish the presence and absence of at lease a minimal level of student involvement in the activity at hand.

A third domain of student behavior is the level of success with which the student carries out an activity. This can also be conceived in terms of the difficulty of the activity for a given student. Clearly, it is possible for a student to be intensely involved in an activity that is directly relevant to some area of measured learning, despite the fact that no learning actually occurs. Many complex models might be used to explain different possible causes for this lack of learning. A relatively simple model will be incorporated here. That is, if the student has previously mastered the learning activity at hand, then she/he cannot show further measured learning in terms of that particular activity, regardless of how much intense involvement the student maintains in the activity. Similarly, if the student is so unprepared for an activity that she/he is totally unable to carry out any aspect of it correctly, then she/he will not learn by performing the activity.

On the contrary, repeated incorrect performance of an activity could result in "negative" learning, where the student learns the incorrect responses. The procedures to be described in this manual require that observers distinguish between three levels of difficulty of a given task for a given student. These three levels of difficulty do not correspond directly to the absolute presence or absence of learning in the sense of the preceding discussion. However, the categories of difficulty to be identified by observers should show a probablistic relationship with learning based on the logic of the preceding discussion. (See the explanation of difficulty levels, later in this manual.)

Additional features of student behavior are also examined using this observation system. These include determinants of the pacing of the learning activity, the response mode of the student when actively engaged in an activity, and categories for student behavior to be used when the student is not engaged in the designated learning activity. However, the core of the observation system revolves around the three domains discussed above: 1) the relevance of the student activity to mathematics outcomes, 2) the presence or absence of student engagement in the activity, and 3) the general level of difficulty of the activity for the student.

As stated previously, the observation system will be used to describe the teacher's activities in terms of the individual students and student behavior to which the teacher's activities pertain. Teaching behaviors will be analyzed in terms of both the concurrent student behavior and subsequent student behavior.

The model of classroom learning, upon which this observation system is based, views teaching activities in terms of two domains: 1) planning activities, and 2) interactive activities. Planning activities consist of

the diagnostic and prescriptive behaviors that determine how instruction will take place. Planning activities are generally not observable, insofar as they occur "inside the teacher's head". Therefore, this domain of teaching behaviors will be assessed primarily with interview and questionnaire procedures, simply asking the teacher to explain how she/he plans instruction. Planning activities will not be observed.

The second domain of teaching activities, interactive behaviors, consists of instructional moves carried out in the classroom. These will be assessed by direct observation. This observation will focus on the way in which the teacher provides explanations, feedback on the correctness of student responses, monitoring of student learning, and control of student behavior. Observers will code not only the instructional moves of the teacher, but also those of other adults and students who provide instruction. These different sources of instruction will each be distinguished so that it will be possible to analyze their relative effectiveness. Observers will also differentiate between instructional moves that focus on the individual student being observed and moves that focus on a group of which the individual student is a member. This will allow for a rough dichotomization of instructional moves in terms of the extent to which they are designed for the needs of an individual student as opposed to the needs of a group to which she/he belongs.

Observation procedures. The basic system for observing and coding the student and teacher behaviors discussed above is a "time-sampling" procedure. Time-sampling involves the observation of a single "moment" within a longer period of time. The moment is described according to the observational categories that best describe the "event" taking place

at that moment. These categories are then attributed to the longer period of time from which the moment was sampled. Hence, if the observer samples a moment during which a student is doing mathematics seatwork while the teacher provides him/her with feedback, then the appropriate codes for this event are recorded within the time period of that sampling. If that time period is four minutes long, then four minutes of mathematics seatwork with feedback from the teacher will be assigned to the student for the purposes of data analysis. It is likely that some sampling error will occur using this procedure. In the example cited above, the seatwork and feedback may not have continued throughout the entire four minute period. However, it can be expected that such errors will cancel out when a very large number of moments are sampled and averaged together.

In addition to sampling moments in time, the system involves the sequential sampling of "target students" (sometimes described as "identified students") during each "cycle" or time period. That is, during the four minute period in the example above, moments would also have been sampled for each of the other students who had been previously identified as target students. One sampled moment for each of the target students constitutes a complete cycle. This cycle determines the time period to which each of the sampled moments is attributed. Target students are sampled according to a previously specified sequence. The observer must systematically sample each target student's moment immediately after completing the coding for the previous target sutdent in the sequence. This procedure minimizes the possibility of observer bias in the sampling of moments.

It is essential to this observational system that all categories coded for a single event (one sampled moment) be interrelated. For example, if a student is coded as not engaged, then she/he must be "not engaged" in the

content area that is coded for the same event. Similarly, if the coding indicates that the teacher is providing an explanation to the student, then that explanation must pertain to the content area that is also coded for that event.

GENERAL PROCEDURES FOR OBSERVATION

Target student recognition. The first task for the observer is to learn to identify each target student by name. It is advisable that observers memorize the names of target students before visiting classes. This should facilitate the pairing of names and faces. This is not easy, but can be accomplished with the aid of the teacher. It may be helpful to jot down a description of each target student.

Familiarity with class organization. It is also important that observers have some familiarity with the organization of mathematics instruction in a class before observing it. This can be obtained from the information collected with the initial teacher interview/questionnaire. Observers should be aware of any possible complications, such as students leaving for a math laboratory or some other special instruction. The interview/questionnaire will be kept on file at Far West Laboratory.

Avoiding communication with students. Another procedure that should be followed during observation is the avoidance of communication with any students. In fact, it is usually advisable to concentrate on the observation and coding so intently that eye contact with students is avoided. Students will tend to ask observers for help with their work, or will ask about what the observer is doing. Observers will find that they do not have time to help students and code observations simultaneously and that a student who has been given help once will expect to receive it whenever it is requested thereafter. It is less distracting to provide terse explanations of what the observer is doing, but even this presents problems when the student is not satisfied with a terse statement and demands elaboration. For these reasons and others, the simplest and most reliable procedure is to concentrate

on coding observations and avoid even eye contact with students. The routine response to any student question should be either no response or the statement that both you (the observer) and the student have work to do and should not be talking.

Outside of the classroom, it is possible to maintain a more cordial relationship with the students. However, it is extremely valuable to set the standard of no communication inside the classroom. Students will recognize and accept the distinction.

It should be noted that the avoidance of communication with students is often impossible for the purpose of conducting valid observation. For example, it may be necessary to ask a student where she/he is going or where she/he has been. In addition, it may be necessary to ask a student to try a problem in order to determine the difficulty level of a task for the student. These cases will be discussed further below.

Observing students in different rooms. As pointed out above, students will often leave the classroom during observation. This is a common problem with which the observer must be prepared to deal. When all the target students leave at once and go to the same destination, then the observer simply follows. This presents no problem. However, there will be many instances where some target students leave and others do not, or where all target students leave but they go to two or more destinations. Observers must always prepare for these possibilities before observation. The best way to prepare is to study the interview and questionnaire information available, to talk with the teacher about these possibilities. The most common cases of target students going to different rooms will be routine patterns of the instruction. The observer should always investigate these in advance.

When one or more target student leaves and the observer has no prior information regarding where the student is going, the observer should ask the teacher, the target student, and/or other students in the class, in order to determine where and for what purpose the target student is leaving the classroom. It is a good idea to ask one or more sources (especially the target student him/herself) even when the observer has prior information. This verification of prior information is especially important the first one or two times the observer is in a class.

If target students are separated and the observer has determined where each of them is and what they are doing, then the observer continues observation of the target students in the classroom.

Sampling moments. Observers should use a mechanical, rigid sequencing procedure for sampling moments to be coded. Target students should be observed in the same order throughout observation. This ordering may be determined according to practical considerations, such as the homeroom seating pattern. However, once an order has been determined, it should not be changed. During coding, the observer should sample a moment for a target student immediately after completing the coding for the target student in the sequence. The first "picture" observed for a target student, upon looking up from the coding for the previous target student, must be the moment coded. The observer "takes a mental photograph" of that moment, thereafter determining how it should be coded. This kind of procedure is necessary to minimize observer bias in the sampling of moments. Distinct events often take place in a rapid sequence. Unless the observer follows a very rigid sampling procedure as outlined above, confusion will often arise in determining which of several events should be coded.

Investigating the moment sampled. It should be noted that once the observer has sampled a moment, storing a mental photograph of that moment, then it is possible to conduct brief observation thereafter to determine what coding categories best describe that moment. That is, the observer can thereafter walk over to examine the page that the student was working on, determining its content. If this distracts the student and she/he looks up at the observer, then the observer simply ignores the fact that the student is no longer engaged in work on that page. The student was engaged during the moment sampled, so that behavior is coded.

It is particularly useful for coding engagement that moments be sampled from a distance so that the student is not distracted. Thereafter, the observer can approach the student without concern for disrupting the natural behavior to be observed.

Whereas engagement is best observed from a distance, other variables must be observed from a position near the target student. These include the content of the task on which the student is working, the difficulty level of that task for the student, and the kind of instructional move that the student is receiving at that time. It may be necessary to approach the student and look carefully at a page in order to categorize content. The observer may have to examine several written responses of the student in order to determine the difficulty level for that student. It may be necessary to move closer and listen for several seconds in order to categorize an oral statement of the teacher to the student (an instructional move).

In a few special cases, it may be necessary to conduct some investigation well after the observation of a given moment, in order to categorize

that moment. For example, an observer may be unable to categorize content without further information. In such a case, the observer could delay coding that content until after consulting with staff members at Far West Laboratory. In other cases, it may be impossible to determine difficulty without asking the student to try a mathematics problem. (In the latter case the student may have stopped working and the observer believes that this could be due to the high difficulty of the task, but previous information is insufficient to allow this conclusion. The observer would therefore have to ask the student to try a problem.)

In all cases, it should be clear that the moment to be coded is the one that was sampled initially. The subsequent observations are carried out simply to determine what that moment really was.

Attending to non-target students. It is clear from the discussion above that the target student may be aware that they are the subjects of observation. However, observers should minimize this awareness as much as possible. The avoidance of eye contact, in addition to its previously discussed advantages, will help reduce the extent to which target students feel self-conscious. In addition, it is helpful to keep the observation sheet out of the view of any students. This will prevent students from reading the names of target students written on the coding sheet. However, the best procedure for reducing target student awareness of the observation is to attend to non-target students. Observers can do this in two ways. First, observers can focus on non-target students while they are filling in the code sheet.

The second way to attend to non-target students is to examine aspects of their activities that are identical to those of one or more target students, using the information to code target student behavior. This is

often possible when coding mathematics content categories. For example, if the observer needs to determine what content category is appropriate for a given page in a workbook, it may be just as practical to examine a non-target student's workbook as it is to examine a target student's workbook.

Codes interrelated within events. When a moment is sampled, the observer must determine what single event, consisting of interrelated should be used for the same event. Examples of this were given in the overview of the observation system (see above). However, this is a crucial procedure that warrants reiteration. The content, setting, difficulty level, learner move, instructor move, source, and focus must all be interrelated. That is, the learner move and instructor move must both apply to the content coded and to each other. Therefore, if the teacher is explaining a reading assignment while the student works on a math assignment (ignoring the teacher), then there can be no teacher behavior coded. The target student behavior must be coded, and the ongoing teacher behavior is unrelated to that student behavior. If the teacher's explanation or directions for reading are coded for the same moment at which the student is coded as working on math, then it would appear that the teacher was explaining or giving directions to the math. It is the student that is the core of this observation system. Therefore, his/her behavior takes precedence over that of the teacher.

It is possible, however, that the student could ignore the teacher's behavior, without causing that behavior to be unrelated to the student behavior. If the student is simply not engaged, off-task (perhaps drawing pictures), while the teacher explains a mathematics assignment, then the student can be coded as not engaged in the teacher's explanation of the mathematics.

As mentioned before, the first principle for identifying the event to be coded is that of centering the observation on the student. The second principle is to center the observation on mathematics content. Therefore, in the first example above, the observation centers on the student and on the math task in which the student is engaged. In the second example, the observation centers on the student and on the mathematics instruction in which the student is not engaged. The lack of engagement in mathematics takes precedence over the engagement in art (the student draws instead of listening to the teacher). The observation centers first on the student. This presents the choice of coding either engagement in are or the lack of engagement in mathematics. Mathematics takes precedence over art, so the lack of engagement is coded.

It should be noted that the decision is not always so simple. It may not always be clear that the teacher expects the student to attend to the mathematics instruction. In such a case the observer must make his/her best judgements as to whether the student is really expected to listen to the mathematics instruction, or whether the teacher has accepted the drawing as a legitimate activity. These ambiguous situations will be uncommon. Generally, the student would be coded as not engaged in mathematics. Further discussion of this procedure appears below, under the explanation of the general content categories.

Multiple moments sampled with one event. It is possible to sample several moments from the same event. This will occur for relatively long events. For example, if the teacher takes a student aside for special tutoring over a period of twenty or thirty minutes, that that event would be sampled for each of several cycles. In fact, this will be common. Whenever a relatively stable activity occurs, it is likely that the same

event will be sampled repeatedly on successive cycles. This provides the observation system with a rough estimate of the duration of events. Shorter events will tend to be sampled on only one cycle at a time. Longer events will tend to be sampled on several consecutive cycles at a time.

Cycle duration. One cycle (sampling one moment for each of the six target students) should require no more than six (6) minutes and no less than three (3) minutes. The average duration of cycles over an observation day should be about four (4) minutes.

EXPLANATION OF OBSERVATION CATEGORIES

General Content. General content codes are used to provide a basic description of the activities, other than mathematics, that may take place during the observation period. It is important to note that this refers only to activites having no instruction relevance to mathematics. (An activity may involve mathematics without being designated by the teacher as a "mathematics" task.)

Five categories are reserved for the non-mathematics activities (general content). These are transition, management, break, other instruction, and absent. The purpose of coding time in these categories is to obtain a description of how the observation period is organized. Of particular interest are considerations related to the efficient use of time and the extent to which variety and diversion are built into the daily schedule.

The first two of these categories, transition and management, are expected to have some relationship with the efficiency of classroom operations. If any one of these categories occurs in excess, then it is probably an indicator of the inefficient use of time. However, some time should be expected to fall into these three categories in any normal classroom.

The next two categories in this group, break and other instruction, should be related to the variety of activities conducted during a day and the extent to which a student is allowed recreation and other diversions. A break is considered a completely recreational period, allowing the student to relax between instructional periods. An other instructional activity demands more of the student's concentrated attention and effort then does a break, but still provides some diversion from the demands of a mathematics task.

No setting, difficulty, learner move, instructor move, source, or focus need be coded during any of the five general content activities. Therefore, if T, M, B, O, or A is coded, then no other code should be used in the same coding row. This procedure is followed because these categories exclude instruction related to the learning of mathematics so that no information is considered necessary on details describing the conduct of this instruction. Obviously, the observer's task is greatly reduced during any of these five general content activities in that only one code is required for each event.

It is important to note that mathematics content is given priority over the five general content categories, in terms of coding the activity in which the student is actually engaged. If the teacher is conducting one of the five general content activities (and expects all students to be so engaged), but a target student is actually engaged in mathematics, then the observer should code the target student as engaged in the mathematics. However, if the teacher is conducting mathematics (intending that all students be engaged in that instruction) and a given target student is actually engaged in one of the general content activities (perhaps doing artwork), then the observer should code the target student as not engaged in the mathematics instruction (rather than coding the other instruction, artwork).

The first general code is transition (T). This code is used for periods of change from one activity to another. Hence, whenever students must move from one location to another because a subsequent activity occurs in a different place than did the prior activity, then transition is coded. Transition also includes time required to quiet students between activities, because students generally tend to get more noisy after one activity ends

and before the next one begins. Hence, "quieting down time" is part of changing from one activity to another. Transition also includes periods of no activity that might occur when a student finishes his/her work early and no other activity is initiated. Examples of transitions include lining up, taking seats, or establishing order during a period of change in activities. The latter might consist of the teacher instructing all students to put their heads down on their desks for a few minutes while the lights are turned out. It might also consist of a disciplinary remark by the teacher to one or more students.

Disciplinary actions carried out within another activity are not transitions. These are considered task engagement feedback negative, in that they are designed to maintain the appropriate student behavior with respect to an on going task. This is to be differentiated from disciplinary actions that occur during transitions, when there is no task or activity.

It should be noted that task engagement feedback, positive or negative is coded as an instructor move only during mathematics activities.

Although a student can terminate his/her transition by starting a new activity, a student would not generally initiate a transition. If a student finishes one activity, then transition (T) would be coded when no subsequent activity has been designated. If another activity was previously designated to be carried out immediately after the activity the student has just finished, (e.g., when the teacher had said, "When you finish your math, start your next reading chapter"), then that activity would be coded immediately, without any transition. (The student might be coded as not engaged — interim or not engaged — off-task.) However, in some unusual instances the student might initiate his/her own transition. For example, upon finishing an activity just before a recess or lunch period, the student

might line up at the door without instructions by the teacher to do so. In this case, the most appropriate code is transition, because the student is obviously conducting a transitional behavior during a period of no assigned activity. (Note that although there is no assigned activity for that student, others may still be working so that they still have an assigned activity.)

It should be noted that when other activities are carried out simultaneously with a transition (such as giving instructions for mathematics homework while the students are lining up to go home), then the other categories are coded. That is, other activities are given priority over transitions for the purposes of coding.

The second code is management (M). This refers to the conduct of class business that is unrelated to any instructional activity. This would include the collection or redistribution of milk money, the distribution of milk, writing the names of free lunch recipients on the blackboard, discussing or making arrangements for a field trip, completing administrative forms, etc.

Often, management will occur simultaneously with a transition. For example, students might start lining up to leave for lunch while the teacher reads aloud the names of those who will get a free lunch. This should be coded as management period, because other activites are given priority over transitions (as discussed above).

The third code, break (B), refers to any recreational of free period. This includes recess, unstructured P.E., lunch, milk breaks, and non-instructional games. Unstructured P.E. refers to P.E. periods where students are free to do whatever they choose, so that the period is essentially indistinguishable from a recess except that it is called "P.E." Direct

teacher supervision of the P.E. activity (such as calisthenics or a baseball game) would constitute structuring, so that the activity would be coded as other instruction (see below).

Breaks will usually be officially designated break periods. The break code should not be used for "dead time" in the classroom (this would be coded transition) or for periods during which students are not engaged in a designated activity. However, in some cases it is possible for a student to initiate his/her own break. For example, a student might complete a mathematics assignment and have no subsequent activity designated by the teacher. This is coded as a transition period if the student starts no other activity, it is coded other instruction if the student draws, or reads a library book, etc. Therefore, following the same reasoning, if the student plays a game of Monopoly in the back of the room, then a break is coded. If it is a math game, use a math content code.

Using the restroom and getting a drink of water is not coded as break unless the teacher designates a period for these activities. Therefore, if the teacher stops a testing session and lets the students leave to use the restroom, a break is coded. However, if a given student must leave the room to use the restroom or to get a drink of water, then the ongoing activity is still coded for that student. If that ongoing activity is a general content activity (such as other instruction), then no code would be used to indicate that the student left for the restroom or drinking fountain. However, if the student leaves during a mathematics activity, then the mathematics content is coded and the learner move, not engaged-off-task, is coded. (See discussion of learner moves, following.)

The fourth general content code, other instruction (O), refers to a wide range of organized classroom activities that do not fall within

definition of mathematics instruction. This category includes flag salutes, fire-drills, sharing, storytime, music, art, reading, social studies and structured P.E. It might also include a regularly scheduled individual conference or group discussion on general behavior problems. (Discussions of behavior relevant specifically to mathematics instruction would be coded as task engagement feedback negative under mathematics content).

As a general rule, observers should not attempt to infer the teacher's intent with regard to a designated instructional activity. Rather, the observer should code the explicity (verbally) designated activity (giving priority to any student engagement in mathematics). For example, the teacher might instruct the students to work on mathematics. If the target student stops working on the mathematics before finishing it and begins to play with a nonacademic game, then that student is coded as not engaged in mathematics, even if the teacher tactitly accepts the game activity. This tacit acceptance of the game might range from ignoring the student playing the game to actually answering a student question regarding how the game is played. Only if the teacher verbally and explicitly indicates that the game is an acceptable activity, stating that the student may play the game rather than work on the mathematics, can the Break (B) code be used.

The priority of mathematics content, discussed above for nonacademic instruction, applies to all of the general content codes and is particularly important for other academic instruction. Therefore, if an other academic activity involves any mathematics, such as performing computation for a science task, mathematics is coded. Also, if a student works on another academic activity during a mathematics period (without having finished the mathematics assigned for that period), then the student is coded as <u>not</u> engaged in the mathematics assignment. As discussed above, the activity

assigned by a teacher should be determined according to explicit (verbal) designations of the teacher, rather than implicit designations inferred by the observer.

The fifth and final general content code is absent (A). This is used for time during which a student is not at school. It is important that the observer be certain that a student coded as absent is not involved in an activity in another room. Absence can be verified by checking with the teacher.

Mathematics Content. The coding of mathematics content is central to this observational system, because of the fact that learning is to be measured in terms of mathematics. For this reason, mathematics activities are given priority over the general content categories. As explained previously, the priority of mathematics is manifested in the coding of student engagement in mathematics ahead of any alternative student non-engagement, and the coding of student non-engagement in mathematics ahead of any alternative engagement is a non-mathematics activity. Therefore, if the target student is engaged in mathematics, that activity is coded rather than any alternative activity that the teacher may have assigned to that student. This holds even when the teacher has assigned a different mathematics activity. That is, we always want to know when the target student is involved in any mathematics activity, regardless of what other intentions the teacher may have at that time. In addition, if the target student is not engaged in mathematics, but the teacher has assigned some mathematics activity, then the student's non-engagement in the assigned mathematics activity is coded. This holds even if the student is working diligently on some other academic content (involving no mathematics). That is, we always want to know when the student is not working on mathematics if mathematics has been assigned.

It should be noted that the "assignment" of mathematics is determined according to the verbal (oral or written) indications of the teacher. Observers should not attempt to infer the teacher's intentions. Therefore, even though the teacher may seem to implicitly accept the student's engagement in an activity other than the assigned mathematics (such as when the teacher observes but does not object to the student's alternative activity), the student's non-engagement in the assigned mathematics is still coded.

Only when the teacher explicitly states that the student may engage in the alternative activity is the engagement in that activity coded rather than non-engagement in assigned mathematics.

The observer should remember two qualifications to the discussion above. First, if the student's alternative activity is also mathematics, then the engagement in that alternative mathematics is coded. Second, if the student has finished the assigned mathematics (and there is no additional mathematics activity) then engagement in a non-mathematics activity would be coded because the assigned mathematics no longer applies to that student.

The content coding categories for mathematics are described on the following pages.

OUTLINE OF MATH CONTENT CATEGORIES

	Math Content	Observation Code
COMPUTATION	Addition/Subtraction, no regrouping, standard short form	AS
	Addition/Subtraction, no regrouping, Instructional Algorithms with Place Value Transformations	PV
	Addition/Subtraction with regrouping, standard short form	RG
	Addition/Subtraction with regrouping, Instructional Algorithms with Place Value Transactions	PV
	Multiplication, Basic Facts, Speed Tests, and Algorithm	MU
	Division	DI
	Fractions	FR
	Other Computation	MR
CONCEPTS/APPLICATION	Computational Transfer (properties, no patterns, missing addends, number of sentences with inequalities, factors, multiples)	CT
	Place Value/Numerals	PV
	Word Problems	VA
	Geometry (perimeter, area, number pairs, lines or figures	SA
	Other Concepts	SA, MR

1. Addition/Subtraction no Regrouping - Standard Short Form (AS)

Learning the basic addition and subtraction facts. Finding the sum or difference of problems which do not require the renaming of 10 ones as 1 ten or 1 ten as 10 ones (i.e. no "carrying" or "borrowing").

Includes:

A. Basic facts: Basic addition facts are the sums of two single digit addends up through 9 + 9. The basic subtraction facts are the inverses of the addition facts and therefore include facts up through 18-9.

B. Non regrouping problems in addition: Sums of a single digit and a multiple digit addend or two or more multiple digit addends which do not require the renaming of 10 ones as 1 ten.

10	23	547
+ 5	+ 46	+ 201

Includes column addition without regrouping.

6	20	21
4	30	13
+ 5	+ 10	+ 15

C. Non-regrouping problems in subtraction: Finding the difference between a single digit and a multiple digit number or the difference between two multiple digit numbers which do not require the renaming of 1 ten as 10 ones.

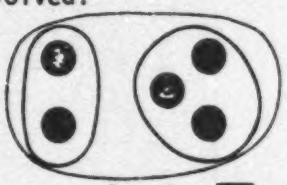
$$\begin{array}{r} 27 \\ -\ 7 \\ \hline \end{array} \qquad \begin{array}{r} 48 \\ -\ 14 \\ \hline \end{array} \qquad \begin{array}{r} 532 \\ -\ 420 \\ \hline \end{array}$$

Note: Problems in this category can be presented in a variety of formats.

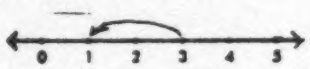
The problem may be laid out horizontally or vertically:

$$\begin{array}{r} 2 \\ +\ 3 \\ \hline \end{array} \qquad \begin{array}{r} 3 \\ -\ 2 \\ \hline \end{array} \qquad 2 + 3 = ___ \qquad 3 - 2 = ___$$

Pictorial representation may be used to help the students understand the basic processes of joining or separating sets and/or as an aid in carrying out the computation involved:



$2 + 3 = \square$



$3 - 2 = \square$

In all of the examples above, the primary task is to find the sum or difference between two numbers when both of those numbers as well as the applicable operational sign are given.

However, there are situations where instructional algorithms or processes involving place value concepts are used in the teaching of these same computational skills and when this occurs the instruction should be coded under category #2 (see section #2).

There are other situations which require more than the straightforward computation of a sum of difference (but do not involve place value) and these situations are discussed in the Computational Transfer Section (#7).

2. Addition/Subtraction no Regrouping- Instuctional Algorithms With Place Value Transformations: (PV)

In our base 10 number system the understanding of place value is essential to the learning of computational skills. With this in mind, curriculum materials often include instructional algorithms or processes which combine place value concepts along with practice in computation. These processes may involve expanded notation or the designation of tens and ones. Some common (depending on text) instructional algorithms are:

$$\begin{array}{r} 14 = 10 + 4 \\ +\ 14 = 10 + 4 \\ \hline 20 + 8 = 28 \end{array}$$

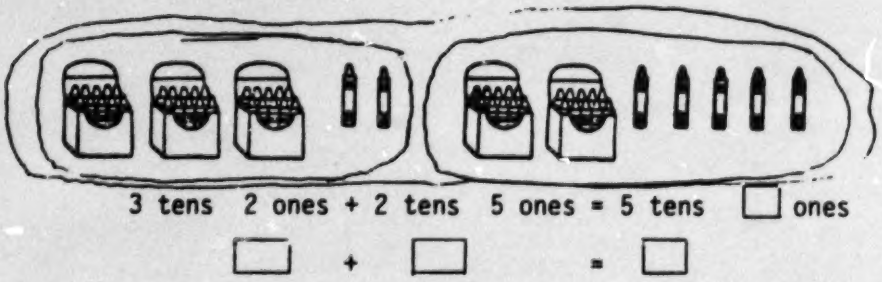
(Use of Expanded Notation)

	TENS	ONES
14 =	1	4
+ 14 =	1	4
	2	8

(Designation of ten's and one's place)

$$\begin{array}{r} 14 \\ +\ 14 \\ \hline 8 \\ 20 \\ \hline 28 \end{array}$$

(Long form with partial addends)



3. Addition/Subtraction with Regrouping - Standard Short Form (RG)

Addition problems which require the renaming of 10 ones as 1 ten ("carrying") and subtraction problems which require the renaming of 1 ten as 10 ones ("borrowing"). Here we want to include only the regrouping problems which are presented in the standard computational algorithmic format, also known as the short form.

$27 + 3 = \square$

$$\begin{array}{r} 18 \\ +\ 14 \\ \hline 32 \end{array} \qquad \begin{array}{r} 13 \\ 15 \\ +\ 16 \\ \hline 44 \end{array} \qquad \begin{array}{r} 26 \\ -\ 9 \\ \hline 17 \end{array} \qquad \begin{array}{r} 40 \\ -\ 15 \\ \hline 25 \end{array}$$

This category is parallel to category #1 in that the student is given two numbers and told to find their sum or difference but in this case the problems also require regrouping. The general guidelines on format in category #1 also apply to this category.

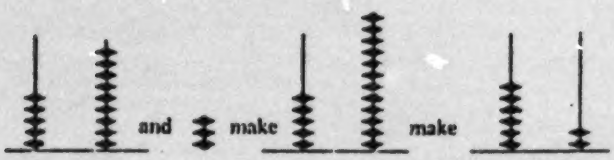
4. Addition/Subtraction with Regrouping - Instructional Algorithms With Place Value Transformations: (PV)

Regrouping problems in a format which includes place value concepts. Here the instructional algorithms help explain the regrouping processes which underlies the "carrying" and "borrowing" techniques used in the standard short form.

Examples:

$$\begin{array}{r} 16 = 10 + 6 \\ +\ 14 = 10 + 4 \\ \hline 20 + 10 = 30 \end{array} \qquad \begin{array}{r} 16 \\ +\ 14 \\ \hline 10 \\ 20 \\ \hline 30 \end{array}$$

$$\begin{array}{r} 16 \\ +\ 14 \\ \hline \end{array} \qquad \begin{array}{|c|c|} \hline \text{TENS} & \text{ONES} \\ \hline 1 & 6 \\ 1 & 4 \\ \hline 3 & 0 \\ \hline \end{array}$$



5 tens 9 ones + 3 ones = 5 tens + 12 ones = ☐ tens ☐ ones

59 + 3 = ☐ + ☐ = ☐

$$\begin{array}{r} 32 = \\ -\ 16 = \\ \hline \end{array} \qquad \begin{array}{r} 30 + 2 = \\ -10 - 6 = \\ \hline \end{array} \qquad \begin{array}{r} 20 + 12 \\ -10 - 6 \\ \hline 10 + 6 = 16 \end{array}$$

$$\begin{array}{r} 32 = \\ -\ 16 = \\ \hline \end{array} \qquad \begin{array}{r} 20 + 12 \\ -10 - 6 \\ \hline 10 + 6 = 16 \end{array}$$

5. Computational Transfer - Tasks which require the student to recognize and apply some of the operational concepts and patterns within our number system. The student must understand and use the operations which underlie computation, but in a format which involves more than straight-forward computation. Includes:

A. Properties:

1. Commutative property of addition and multiplication

   $3 + 2 = 2 + 3$

   $2 \times 3 = 3 \times 2$

2. Associative (grouping) property of addition.

   $2 + (3+5) = (2+3) + 5$

3. Properties of zero.

   Identity element of addition: $18 + 0 = 18$
   Inverse relationship in subtraction: $18 - 18 = 0$

B. Number Patterns: Tasks which promote the student's search for and recognition of the various patterns which can be found among numbers.

Examples:

1. Counting by 2's (odd and even numbers).
2. Counting by 5's, 10's, 20's, etc.
3. Functions - discovering or applying a function rule like add 3, subtract 2, etc.

   a. Rule is given:

+	2	5	7	9
4	6			

   b. Student must discover and apply the rule to complete the pattern.

1	3	8	4
4	6	11	?

7, 5, 3, ?

{(1,2), (2,4), (3,6), (4,?)}

C. Missing Addends - Open sentences: Number sentences in which the sum or difference is given and one of the addends or numbers is unknown.

Examples:

$$\square + 3 = 7 \qquad 4 + \square = 7 \qquad \square - 5 = 5 \qquad 5 - \square = 2$$

$$\square - 3 = 4 \qquad 7 - \square = 3 \qquad \square + 6 = 10 \qquad 4 + \square = 10$$

D. Number Sentences With Equalities and Inequalities - Includes only those number sentences that involve computation plus the use of >, <, =, +, -.

$7 - 6 < 1 + 3$ $\qquad$ $7 \triangle 2 = 5$

$7 > 4 - 3$ $\qquad$ $8 \triangle 3 = 11$

$10 + 10 = 15 + 5$

This category does not include the use of inequality signs in numerical comparisons. i.e.

$27 > 26$
$127 > 126$
} This should be coded PV

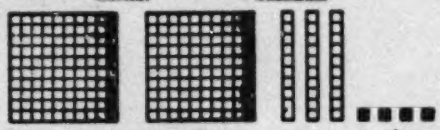
6. Place Value/Numerals (PV) - Place value involves the concept that a digit has three meanings: It's face value (the meaning it has wherever it is used), it's place value (the meaning it takes from it's place in a numeral), and it's total value (which is the product of the first two values). In the numeral 45, the 4 has a face value of four, a place value of ten, and a total value of forty. Teaching place value will involve expanded and compact notation, identification of the one's, ten's, or hundred's place, and naming the number of tens (or ones, etc) in a numeral.

Numerals includes understanding the order of the counting numbers and evaluating the sequential position of one numeral in relation to another. Comparing and evaluating numerals will involve place value concepts.

Examples:

A. Place Value:

1. How many tens in 75?
2. Which number is in the one's place?
3. 6 tens and 2 ones = 60 + 2 = 62
4. 155 = 100 + 50 + 5
5. Use of manipulatives or pictures to teach numerical structures.



2 hundreds, 3 tens, and 4

We write 234.

B. Numerals:

1. Writing the missing numerals.

46			49	

2. What number comes before, after, or between?
3. Using inequalities: 145 > 135.
4. Comparing sets of objects. e.g.

7. Multiplication - Basic Facts (MU): Multiplication with two 1-digit factors. Also known as times table up through 9 X 9.

8. Multiplication - Speed Tests (MU): Timed tests in the basic multiplication facts. May also include speeded flash card drill which is specifically aimed at increasing automaticity. Code ACTUAL TIME ONLY. That is, for a one minute speed test, code 1 minute to speed tests. Code any time in preparation, scoring, or collecting tests to other computation.

9. Multiplication-Algorithm (MU): Multiplication with one factor of two or more digits, i.e., all multiplication above the basic facts.

10. Division (DI): Division of whole numbers. All levels of difficulty. Includes speed tests in division.

11. Fractions (FR): Computation with fractions including the recognition and identification of equivalient fraction. Doe include identifying the fractional part of a set or region.

12. Other Computation: (MR)

Examples:

A. Decimals (addition, subtraction, multiplication or division of),
B. Computation in a base other than 10.
C. Computing averages.

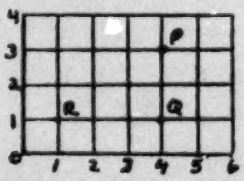
13. Word Problems: (VA) All types of word problems including word problems with graphs. The coding of word problems is given priority over the specific computation required by the problems. Therefore, regardless of the computation, time on word problems is coded under word problems.

14. Geometry - Perimeter: (SA) Computing the perimeter of a polygon using standard or arbitrary units of measure.

15. Geometry - Area: (SA) Computing the area of a polygon using standard or arbitrary units of measure.

16. Geometry - Number Pairs: (SA) Identifying number pairs on a number plane.

Example:



What is the number pair for point Q?

17. Geometry - Lines or Figures: (SA)

Recognizing and identifying common lines and plane figures. Includes angles, parallel and perpendicular lines, parallelograms, rectangles, squares, and right triangles. Does not include work with solid figures like spheres, rectangular prisms, etc.

18. Geometry - solid figures
volume
coordinates
shapes

18. Other Concepts: (MR) Other concepts and applications:

Examples:

liquid or weight measures
statistics and probability
constructing line and bar graphs
set theory, set diagrams, logic
place value with decimals
exponents (concepts of)
averages (concepts of)

A few general guidelines should be used when coding mathematics content. First, the observer should code as close to the moment sampled as is practical. That is, if the top half of a page has items in one content category, while the bottom half falls into another category, then the half of the page that the student is working on at the moment sampled should determine the content category to be coded. Content coding may even be practical on a problem-by-problem basis in some cases, where a student works on each problem for several minutes. (It is important to note that difficulty level, to be discussed later, is never coded on a problem-by-problem basis. The observer should always code the difficulty of a particular kind of problem in general, rather than coding according to whether a student is right or wrong on each problem separately.)

A second guideline is that the focus of a given problem or set of problems should be coded when operations related to more than one content category are involved at once. For example, if multiplication and addition are involved in an exercise focusing on the drawing of matrices with specified numbers of units per side, then spatial application is coded because it is the focus of the task. Multiplication and addition are involved, but are not central.

In some cases there will be no single focus to an event. The most common example is the directions given for a set of problems involving several different content areas. This would be coded as mathematics related.

A third guideline is that the observer should be prepared to erase and change previous content coding when it becomes apparent, upon subsequent observation, that the previous coding was incorrect. Therefore, do not routinely code directions as mathematics related simply because the content involved is not always apparent at the time that the directions are given. If an appropriate content focus becomes apparent after the directions have been given, then the observer should recode, thereby using the most accurate description of the previously observed moment.

Notes on mathematics. Mathematics is a relatively hierarchical subject matter area. Therefore, it is important to code the higher level operations that are undertaken in a given task, rather than coding all of the subskills that may also be involved. An obvious example is division. Subtraction and multiplication will generally be embedded within instruction on division, but only the division should be coded.

Mathematics related includes liquid or weight measures, statistics and probability, set theory, set diagrams, logic, place value with decimals, concepts of exponents, and concepts of averages at grade five other concepts. It includes decimals, computation in a base other than ten, and computing averages at grade five other computation.

It should be noted that copying is coded as below grade level for mathematics. This would include copying the heading or directions for a mathematics task and copying a set of problems without deriving answers at the same time. Copying problems without deriving answers would usually take the form of copying a set of computational problems off a blackboard.

If the student copies all the problems before computing any of them, then the copying time is coded as below grade level. If the student computes an answer to each problem immediately after copying it from the board, then the appropriate computation code is used even during the copying, because it is assumed that the student may have been considering the computation of that problem while copying it.

Setting. The setting codes are used if and only if mathematics content is coded for the same event. The setting, or pacing, of the mathematics activity is coded to characterize the cognitive demands that the activity places upon the student. An activity is coded as self-paced if it is designed so that the student can think at his/her own pace, using as much or as little time as desired for each problem completed. The other-paced code is used for activities that require the student to proceed at an externally determined pace.

The general rule for coding setting is to code self-paced whenever the student can set his/her own pace for two or more problems at a time, while coding other-paced whenever the student cannot set his/her own pace except (at the most) within a single problem at a time. This somewhat arbitrary dichotomy is useful for increasing the reliability of observational coding.

The self-paced code is generally used when a student is working independently, such as during tasks described as "seatwork." However, following the rule given above, the self-paced code is used for timed or speed-tests whenever the student is allowed to work through two or more problems within a single timed-period. If the student is directed through the test on a problem-by-problem basis, as when the teacher reads each question before the student answers it, then other-paced is coded. The self-paced code is also used in most one-to-one tutoring situations.

Although tutoring may appear to involve problem-by-problem pacing by the instructor, it is likely that the student is at least as influential as the instructor in determining that pace (at least whenever there is only one student).

The other-paced code is used for lectures, recitation exercises (oral question-and-answer activities), flashcard exercises, group discussions, and any written activity (including workbooks and tests) where the teacher takes the students through each problem one at a time. Explanations or directions provided by an instructor to more than one student at a time are coded as other-paced. Explanations or directions provided to a single student (as tutoring) are coded as self-paced.

Setting should be coded as close to the moment sampled as is possible. Therefore, if the observer samples directions for a self-paced seatwork activity, given by the teacher to the entire class at once, then the other-paced code is used. Similarly, the other-paced code is used for the moment that the teacher interrupts a self-paced, seatwork activity to explain some aspect of that seatwork to the entire class as a group. However, the self-paced code is not used when the teacher explains something to an individual student in the middle of a group activity, unless that explanation is provided in such a way that the other students could not attend to and understand it.

Difficulty. The difficulty level of a task for the target student, easy, medium, or hard, must be coded for all mathematics events. Difficulty is coded to indicate the cognitive demands of the mathematics task for the individual student. It is expected that learning will be related to the amount of time that students spend working at each of the three difficulty levels.

Easy represents work on existing knowledge or skills of the student. Time at this level may serve as useful reinforcement of existing skills. However, it may also consist of unnecessary repetition or even overlearning. It is expected that time in the easy category will be positively related to learning outcomes up to a point, but that beyond some optimal level, time in the easy category will show diminishing increments of learning.

Medium difficulty is the middle range between easy and hard, representing those activities that are generally challenging for a target student involving some unacquired and some existing knowledge or skills of the student. It is expected that time spent in the medium difficulty range will tend to show a positive relationship with learning outcomes.

Hard is a category consisting of tasks that the target student cannot perform beyond a chance level of correct responses. That is, the student shows essentially no understanding of the task. Time spent at the difficulty level, hard, is not expected to show a positive relationship with learning. In fact, a negative relationship would not be entirely surprising.

It should be noted that the category, hard, will generally occur much less frequently and over shorter periods of time than will easy and medium. Hard activities may never be observed for some target students or, perhaps, never in some classes. The categories, easy and medium, however, are both fairly common. Each of these two categories will usually represent a substantial amount of time for every target student.

The primary basis for determining the difficulty level of a task for a target student is the error rate of that student for the kind of problems included in that task. However, in addition to error rate, the speed with which a student works will sometimes be used to differentiate the easy and medium difficulty categories. The easy category is characterized by a very low error rate, where the student appears to be responding with virtually no errors, except what you might expect by chance (careless errors). The hard category is characterized by an extremely high error rate, where the student appears to show virtually no correct responses, except what you would expect by chance (luck). The medium category includes the the range between easy and hard. The additional consideration of the speed with which the student works through the problems enters in when virtually no errors are observed, but the student is working at a noticeably slower than average pace. If such an unusually slow but errorless response rate is not simply a function of a low level of engagement, but in fact appears to be the result of the difficulty of the task for that student, then medium would be coded rather than easy.

The observer should take into account the speed with which the student completes a task only when the student is obviously much slower than the average student at that grade level working on that task. For example, if the target student has spent 30 minutes on the first three problems of a 20 problem computation worksheet, while most of the class completed the entire worksheet in less than 30 minutes, then medium would be coded even if the target student has answered those first three problems with no errors. However, in such a case, the target student may display a low rate of engagement. The difficulty of the task may be the cause of the low engagement rate. However, the low engagement rate could be the cause of the apparent difficulty of the task. In addition, if the student has rarely been engaged and has completed only a few problems, then the observer may not have ever seen the student actually complete a problem. Hence, the observer may not know whether the student is capable of correctly completing those problems at all,

in that the target student could easily have copied his/her answers at times when the observer was not present. Therefore, when a student has been completing a task at an extremely slow speed, but without making errors, then the observer will often have to ask the student to do a problem, so that the observer can determine whether the slow work rate is due to task difficulty or to poor engagement and whether or not the student is really able to produce correct responses.

As stated above, the coding of difficulty should be based on the error rate (and speed where applicable) of the target student with respect to the kind of problems included in the task observed. This should include all the generally contiguous problems of the task that are of similar stimulus characteristics and response demands, without including problems from more than one of the content categories of this observation system. Stimulus characteristics refers to such considerations as the number of digits for numerals used in a mathematics task. Response demands refers to such considerations as whether the student must generate his/her own responses or may select a response from choices provided as part of the task.

Problems of similar stimulus characteristics and responses demands that are within the same content category should always be coded with the same difficulty code for a given target student. Although the difficulty code might change for that student over time (usually as a result of student learning, but increased confusion might also be possible), the difficulty code for that student would be the same for all of the problems that are classed together in terms of stimulus, response, and content features. Therefore, if the observer is already aware of the difficulty level of a given kind of problem for a given target student, as judged by previous observations, then the difficulty level of problems of that kind can be coded without further judgments by the observer. Subsequent judgments of difficulty for that class of problems, with respect to the same student, would

only become necessary when the passage of substantial time or intervening events (such as a teacher's explanation) cast doubt upon the current validity of the previously determined difficulty level.

Hence, difficulty level is not coded on a problem-by-problem basis. Within a set of related problems, the fact that a student is incorrent in response to one problem and correct in response to the next does not result in the coding of the first response as hard, and the second response as easy. Rather, all of the problems within the related set receive the same difficulty code, according to the student's performance on the set as a whole.

It should be noted that difficulty is always coded for the academic task that determines the content code for a given event. Therefore, when the student is listening to the teacher give directions or task engagement feedback, the coding of difficulty does not relate to those directions or that feedback per se. Rather, it relates to the content of the academic task to which the directions or task engagement feedback apply.

It should be noted that coding the diffiuclty level for structuring and directing will often involve several content areas, possibly including several different tasks (such as when the student must complete several activities in sequence). It will not always be possible to isolate a single content category to which the sampled moment of observation applies, in that the directions given at a single moment may apply equally to each of several content categories. As discussed previously, the content code in such a case is mathematics related. The difficulty code would usually be medium, because the variety of content areas is likely to include tasks of a variety of difficulty levels, with at lease a substantial proportion in the medium range. Easy would be coded only if all the tasks involved in the directions are easy for the target student. Similarly, hard is coded

only if all the tasks involved in the directions are easy for the target student. Similarly, hard is coded only if all the tasks are hard. Therefore, when there is a variety of content areas involved in a single moment (mathematics related), then the appropriate difficulty code will usually be medium.

To some extent, the extremely simple tasks, such as copying, and the more demanding tasks within the easy category, such as performing computation at a reasonable pace without errors, will be differentiated by their content codes. That is, copying would be coded as mathematics below grade level (MB), whereas the easy computation would be coded in some category of mathematics computation. It should be noted, however, that copying might fall within the medium difficulty category, such as in those cases where the target student is unable to copy according to the intended format required in the directions provided.

Accurate coding of difficulty level will obviously be, itself, an extremely difficult task in some cases. Nevertheless, the difficulty level of mathematics content must always be coded, even when the student is not engaged in the task for which difficulty is coded. Where little information is available for the determination of difficulty level, the observer must make his/her best judgment at the time. Of course, changes in prior coding may be made if subsequent information indicates that the prior coding of difficulty was inaccurate. However, it should be noted that the difficulty level of a task for a student can change over time, so that the observer should be careful not to change prior coding when it is not clear that the prior coding was incorrect for the time period to which it applies.

The judgment of difficulty level must be made on the basis of overt responses by the target student in relationship to the task under observation. Therefore, the coding of difficulty will be less reliable when few or no overt responses are

observable. However, it will be possible to isolate, for the purposes of data anlaysis, those events for which there may have been few or no observable overt reponses. These events will be characterized by the learner move coded with them, indicating that the student's engaged response was covert or that the student was not engaged. Therefore, it will be possible to analyze the extent to which the availability of overt student responses is related to the reliability with which difficulty level can be coded.

It should be noted, however, that the observer can often judge difficulty on the basis of overt responses even when no overt response occurs within the particular event being coded. Previously observed overt responses for the same kind of problems can be used to determine difficulty. In addition, the observer can simply ask the target student to perform a problem overtly (compute a mathematics problem, etc.).

Several specific situations warrant consideration to clarify the application of the procedures described above. First of all, the error rate used to judge difficulty must be evaluated in terms of the probability that a student can guess the answer to a problem without understanding it.

The context within which problems are performed may affect the error rate for those problems. For example, a given student might be able to perform certain computation problems with virtually no errors when working alone at his/her seat. The same student, however, might be so distracted when working at the board in the front of the class that he/she shows a high error rate, possibly even being unable to answer the problems at all. Those problems for that student would therefore be coded at different difficulty levels depending upon whether the student is working at his seat or at the board. Hence, the context within which the problems are performed is considered to be part of the problems themselves, for the purpose of coding difficulty.

Learner moves. A learner move must be coded for each mathematics event, and may not be coded for any event in one of the general content categories. The most important information obtained by the coding of learner moves is the engagement or lack of engagement of the student in the mathematics content of the event. That is, the crucial information to be obtained with the learner move codes is the determination of whether or not the student is actually performing the mathematics task coded. If the student is engaged in the substantive mathematics content of the event, then engaged-written, engaged-oral, or engaged-covert is coded.

If the student is not engaged in the mathematics content of the event, then not engaged-interim, or not engaged-off task is coded. These categories provide information on the actual student behavior when he/she is not engaged in the task, giving some indication of the reason for the lack of engagement. It should be noted that when a not engaged learner move is coded for an event, then the student must be not engaged in both the content and the instructor move for the same event. The only exception to this rule occurs with the instructor move, task engagement feedback, as discussed later in this manual.

Of the three learner moves indicating engagement in the mathematics content of the event, the crucial distinction is between overt and covert student response modes. Engaged-written and engaged-oral are overt response modes, while engaged-covert is (obviously) covert. Overt student responses are defined as those responses that allow the observer (or a teacher) to judge engagement and task difficulty directly, on the basis of ongoing student behavior. This is especially important for task difficulty, where the observational data for overt responses may often be more accurate than the data for covert responses. Given this distinction between overt and

covert response modes, possible differences in the quality of observational data can be taken into account during data analysis.

The two not engaged learner moves distinguish between the lack of engagement due to student involvement in a peripheral activity related to the ongoing task, and the lack of engagement due to the student's outright non-involvement in the task. The peripheral activities are coded as not engaged-interim learner moves and include the non-cognitive, physical behaviors that the student must carry out in order to complete a task, such as getting more paper, marking completed tasks on a class chart, waiting for the teacher's assistance, and waiting for the teacher to return to lead a group activity. The learner move, non engaged-off task, however, indicates that the student is involved in neither the academic mathematics task itself, nor any activity that is peripheral to that academic task. Whereas not engaged-interim may contribute to the completion of the academic task, not engaged-off task does not.

The determination of engagement or non-engagement is central to the coding of learner moves, because this distinction is the most important of those involved in the learner move categories. Whenever there is ambiguity regarding student engagement, the observer should give the student the benefit of the doubt and code an engaged learner move. Non-engagement should be coded only when it is reasonably clear that the target student is not engaged in the mathematics task of the event coded.

Several rules are necessary for the coding of engagement. If the target student is engaged in a mathematics activity, this is coded even though the student may not be engaged in some other activity that has been assigned by the teacher. If the student is engaged in one mathematics activity, even though some other mathematics activity has been assigned, then only

mathematics activity in which the student is engaged is coded. Neither the content, setting, difficulty, nor instructor moves of the other assignment are coded.

As a corollary to the rule above, if the student displays both a non-engaged and an engaged behavior for the same mathematics activity, then the engaged behavior is coded. For example, the student might listen to the teacher's explanation or directions (engaged-covert) while sharpening a pencil (not engaged-interim) or raising his/her hand for help (not engaged-interim). In such cases, the engagement in listening to the teacher is coded.

It is also possible for a student to be engaged in two different mathematics activities simultaneously. This occurs when the student is copying one part of an assignment while the teacher explains or gives directions to another aspect of the same or a different assignment. In this case, the content, learner move, and instructor move of the student listening to the teacher would be coded, rather than the copying. Copying is categorized as below grade level for mathematics. Therefore, other mathematics content that may occur simultaneously with copying (usually when the student copies while listening to the teacher) is given priority over the copying.

If the target student is not engaged in an assigned mathematics activity, then this non-engagement is coded even when the student is engaged in an alternative activity other than mathematics. The determination of assigned activities should always be based upon the explicit, overt behaviors of the teacher (usually verbal behaviors, but possibly including written instruction). Therefore, if the teacher assigns a mathematics activity, but appears to implicitly accept the student's engagement in a non-mathematics activity, then the non-engagement in the assigned activity is still coded. Even if the teacher goes so far as to help the student with the unassigned non-mathematics

activity rather than the assigned mathematics, is the non-mathematics activity coded (with no learner or instructor move because a general content code would be used).

The coding of engagement should be determined strictly according to the student behavior observed at the moment sampled. However, the engaged response mode or the non-engaged activity should be determined somewhat more broadly, according to the ongoing activities surrounding the moment sampled.

The engaged response mode should be determined according to the student behavior that pertains to the coding of engagement and difficulty. For example, a student who is engaged in a written task may, at the moment sampled, pause to think, read a question, erase a mistake, or turn to the next page of problems. Engaged-written would be coded in each case, because written answers are the ongoing response mode of the task that allows the observer to determine engagement and task difficulty. When there is no overt ongoing response mode, engaged-covert is coded.

It should be noted that the rule above cannot be applied too broadly. During a math task, where students are taking turns reciting word problems and explaining how to solve them, engaged-oral is coded if it is the target student's turn to read a problem at the moment sampled, whereas engaged-covert is coded when the target student is reading along silently while another student recites.

Given the background information above, each learner move will now be discussed individually.

The engaged-written code is used for any non-oral (usually motoric) response that allows the observer to determine engagement and difficulty directly. This would include not only writing, but measuring, using

manipulatives, etc. This would not include silent reading where the student uses his finger to guide his eyes across the page, because this behavior provides information only for engagement, not for difficulty. As discussed previously, this learner move is coded according to the ongoing response mode of the task. If the target student happens to be pausing to think or listening to the teacher read the next question during a written task, engaged-written is still coded, because it is the ongoing response mode that allows the observer to determine engagement and difficulty directly for that task.

The engaged-oral code is used for any oral response that allows the observer to determine engagement and difficulty directly. This would include oral reading even when the student is supposed to be reading silently, so long as the student is reading loudly enough that the observer can judge both engagement and difficulty directly. As discussed previously, engaged-oral should be coded only for those moments at which the target student is speaking if the ongoing activity is a group discussion where the students take turns responding orally. In these situations both oral responding and listening to the oral responses of other students are considered to be ongoing response modes, so the target student response of the moment sampled is coded.

The engaged-covert code is used when the student is engaged in the mathematics task but is showing no observable response that allows the observer to determine both engagement and difficulty directly. As discussed above, engaged-covert is coded only when this is the ongoing response mode, not when the student pauses intermittently during a series of written or oral responses. It should also be noted that engaged-covert will often be coded when the student is copying (below grade level) or performing an

interim activity, while he/she listens to the teacher provide mathematics instruction. As discussed previously, the student engagement in listening to mathematics instruction takes priority over simultaneous below grade level or interim activities.

The not engaged-interim code is used for activities that are part of a mathematics task, but do not involve the substantive content of the task. This includes sharpening pencils, handing in and passing out papers, getting books, and waiting for the teacher's help. Opening a textbook and finding the correct page in the midst of ongoing written, oral, or covert engagement would be coded not engaged-interim. However, turning a page in the midst of ongoing written, oral, or covert engagement would be coded for the ongoing engagement in the mathematics substantive content. Also, aimless shuffling through pages would be coded not engaged-off task, unless the student is waiting for the teacher, in which case not engaged interim would be coded. Activities performed by the student to denote the tasks that he/she has completed (such as checking them off on a class chart or in the back of a workbook) are coded as not engaged-interim.

The not engaged-interim code is also used in a variety of situations where the student must devote a relatively significant proportion of time to denoting his/her response to a question or problem. This will often consist of coloring in a particular area, perhaps with a specified color, to indicate a computational answer, a selected geometric figure, a fractional proportion of a figure, etc. A student might also draw a picture to indicate an answer for a mathematics task. The not engaged-interim code should only be used for student response indication in those cases where the time devoted solely to the indication of a response is readily distinguishable from time devoted to reading a question and determining its answer. This will generally

be a function of the speed with which the student can indicate the response. For example, when the student is simply writing the numerical response to a computational problem, then the observer would not attempt to distinguish between response indication and the actual computation time. Engaged-written would be coded for both. However, if the student colors in an area of a picture using a color identified by performing the computation, then the student may spend more time coloring than computing. In such a case, the time spent computing would be coded engaged-written (assuming that the student does write out his answer somewhere), whereas the time spent coloring according to the computational answer would be coded not engaged-interim. However, if the student were to simply pick up a crayon of the color representing the numerical answer and make a quick slash in the area to be colored, thereby spending relatively little time actually coloring, then no differentiation would be made. The entire sequence, in this case, would be coded engaged-written.

It should be noted that students will often listen to the teacher's instructions or directions while performing an interim activity (such as sharpening a pencil). In such cases, the engagement in listening to the instructions or directions for mathematics is given priority over the interim activity. Therefore, rather than coding not engaged-interim, the observer would code engaged-covert (if the student is listening to an explanation, feedback, or question pertaining to the substance of a mathematics task). This procedure is followed because the engaged student activity takes precedence over the not engaged (interim) activity (See previous discussion.)

The not engaged-interim code is also used when the student is not engaged in a mathematics task because he/she is waiting for the teacher to provide help, such as an explanation of a seatwork problem. This would

include the time spent by the student waiting at his/her desk for the teacher to come and provide assistance. Waiting for help would also include the time spent by the student walking up to the teacher's desk to seek help and the time spent by the student walking back from the teacher's desk after having obtained help, all of which is considered time devoted to obtaining help from the teacher. The student could also be waiting for the teacher to return to a group task that cannot be continued without the teacher's presence, such as when the teacher must finish giving directions or read remaining problems. The teacher may have been diverted by any of a variety of other activities, ranging from providing a student with academic assistance on aonther task, to disciplining another group of students, to answering a phone call from the school office. Regardless of the source of the diversion, not engaged-interim is coded for the learner move and nothing is coded for the instructor move (for the target student who is waiting). The not engaged-interim code is also used when the student is waiting for the teacher to complete a non-instructional activity so that a group instruction can continue. This would include time spent by the student waiting for the teacher to pass out papers or write problems on the board. Not engaged-interim would also be coded while the target student waits for another student to pass out papers or write problems on the board. (Note that no instructor move is coded for the teacher passing out papers or writing on the board, whereas not engaged-interim would be coded as the learner move of a target student who passes out papers or writes problems on the board.) Not engaged-interim would also be coded while the student waits for the teacher to read the next problem for a test or for some other instructional task. In addition, this code is used when the target student is waiting for another student to complete a problem so that the group can move on to the next problem.

It should be noted that not engaged-interim can only be coded during a mathematics activity. Therefore, if the target student has completed his/her assignment and there is no subsequent assignment, then there is no mathematics activity for that target student. In this case, the general content code, transition, would be used (with no learner move) rather than a mathematics content code with the learner move, not engaged-interim.

The not engaged-off task code is used when the target student is not involved in the mathematics task in any way, not even being involved in a peripheral activity of the task. While he/she is not engaged-off task, the student might socialize, daydream, behave disruptively, or simply shuffle aimlessly through textbook pages.

Usually the teacher would consider it inappropriate that the student is not engaged-off task. However, this is not a necessary condition for this category. The teacher could tacitly accept the off task activity of the student. For example, a teacher might interrupt a student's mathematics seatwork to ask about the outcome of a baseball game played the day before. In this case, the student is coded as not engaged-off task, with no instructor move. The teacher's obvious acceptance of this socializing does not change its off task characteristics in relationship to the ongoing mathematics. Note that the coding is exactly the same if another student interrupts the target student to ask about the baseball game.

The not engaged-off task code is even used in some cases where the teacher overtly states that the student may leave a mathematics activity temporarily for some other purpose. The not engaged-off task code would be used here when it is clear that the mathematics task is still considered ongoing and will be resumed again soon. For example, a student may leave the room to get a drink or to use the restroom during an ongoing mathematics

activity. This is coded as not engaged-off task even when the teacher tells the student (overtly) that he/she may leave to get a drink or use the restroom. Only when the teacher allocates a period of time for some or all of the students to get drinks and use the restroom is this activity coded as a break. For example, if the teacher allocates ten minutes between sections of a standardized test for leaving the room to get drinks and use the restroom, then this is considered a structured break period and is therefore coded as a break.

It should be clear that the student can only be not engaged-off task when there is a mathematics assignment that the teacher has designated for the student at that time. However, in some cases the determination of which assignment has been designated may become complicated. This will often be true when the teacher states that the students should work on any one of several tasks after finishing a mathematics assignment. The fact that the student has several options makes it difficult to code content until after the student selects one of those options. If the student finishes the initial assignment and never selects a subsequent option, then the student is coded as not engaged-off task. If all of the options are within the same mathematics content category, then that category is coded for the content (in which the student is not engaged-off task). If all of the options are mathematics tasks, but several different mathematics categories are included, then mathemathics related is coded for content.

When a student is coded as not engaged-off task for an event, then any instructor move that occurs pertaining to the task in which the student is not engaged must be coded. Hence, the meaning of this coding is that the student is not engaged-off task with respect to a task with an instructor move that is a part of that task. That is, the student is ignoring the

instructor move. Note that if the student attends to the task-related instructor move then the student is, at that moment, engaged in the task. Note also that the content that is coded for an event with an instructor move must apply to both the task and its related instructor move, whether the student is engaged or not engaged. Therefore, a student can not be coded as not engaged in both a task of one content category and an instructor move of another content category, for the same event.

Is should also be noted that if the student is engaged in a mathematics task and ignores an instructor move pertaining to that task, then the instructor move can not be coded. The student must be coded as engaged, because the student is attending to a mathematics task. The instructor move cannot be coded for the same event because the coding of the engaged learner move would indicate that the student is engaged in the instructor move coded for that event, but this is not true. Therefore not instructor move is coded.

There is one exception to the rule that a not engaged learner move indicates that the student ignored the instructor move coded for the same event. This exception is for the instructor move, task engagement feedback. If a student ignores task engagement feedback, then that instructor move is never coded. The learner move coded with task engagement feedback must represent the student behavior to which the task engagement feedback was directed. Therefore, not engaged-off task coded with task engagement feedback, negative indicates that the student was off task and that the teacher provided feedback pertaining to that off task behavior.

Instructor Moves. Instructor moves are coded only during mathematics events. However, there will often be a mathematics event with no instructor move because students frequently work independently, without immediate interaction with a teacher.

An instructor move coded for an event must be relevant to the mathematics content and the learner move that are also coded for that event. Therefore, if the target student is coded as engaged, then an instructor move can be coded if the student is engaged in that instructor move. Two examples concerning a teacher's explanation illustrate this point. If the student is working on the assignment while the teacher is providing an explanation, but the student ignores the teacher's explanation, then the student is coded as engaged (engagement in math activity takes priority) and no instructor move is coded. However, if the student is coded as not engaged, then he/she must necessarily be ignoring the teacher's explanation (attending to the teacher would constitute task engagement), so that the instructor move is coded. In this case, the coding indicates that the student is ignoring (not engaged in) the teacher's explanation of the mathematics task.

As discussed previously, the exception to the procedure described above, occurs when task engagement feedback (positive or negative) is coded. For this instructor move, the learner move to be coded for the same event must be the student behavior to which the task engagement feedback is directed. In addition, task engagement feedback is never coded if the student does not attend to it, even if the student is not engaged in the mathematics task at hand. Therefore, if the student is receiving and attending to a negative feedback instructor move, directed to the student's off task behavior, then the learner move, not engaged-off task is coded. If the student is attending to positive feedback from the instructor, that is

praise of the student's diligent work on the mathematics task, then the learner move coded is that engagement (written, oral, or covert).

Three of the instructor moves (academic feedback, academic question and explanation) must be related to the substance of the mathematics content coded for the same event. Structure-direct must be related to the goals or directions for that content, but not the learning of the substantive content itself. Task engagement feedback, positive or negative must be related to the student's engagement behavior in relation to the mathematics task coded for the same event.

The academic feedback code is used when the instructor informs the student that a written or oral response was correct or incorrect, or provides the student with the correct response but no explanation as to why that response is correct.

Any explanation is coded with the explanation category (see below). However, the distinction between an explanation and academic feedback can be a fine one. When the teacher provides the student with the correct responses to problems in advance of the student making any attempt to respond to those problems, then one of the two explanation codes is used. For example, if basic addition facts are being taught and the teacher is simply stating basic addition problems and their correct answers, then the instructor move is explanation. However, if a student has just completed a basic addition facts worksheet and the teacher is identifying incorrect answers and providing the corresponding correct answers, then academic feedback is coded. It should be noted that in most cases instruction on tasks that are new to students will involve explanations that go beyond the simple provision of correct responses to problems. However, in some cases the simple provision of correct responses will occur in the form of an instructional explanation, as in the first example above.

In some cases academic feedback will be implicit. This occurs when the student is responding orally and the teacher points out each student response that is incorrect. The student can infer that every response not pointed out by the teacher must be a correct response. Therefore, implicit feedback is being provided even when the student responds and the teacher says nothing, because the absence of a teacher statement indicates that the response was correct.

Academic feedback can also take a written form. However, written feedback is coded only during that time that the target student is actually referring to it. No instructor move is coded while the teacher prepares the written feedback or while the student picks it up. Only while the student examines that feedback is he/she receiving academic information, so the academic feedback is coded at that time. Therefore, while the student examines the teacher's written corrections of his/her worksheet, academic feedback (instructor move) is coded from the teacher (source) to the target student (focus). (The target student is the focus because the corrections pertain specifically to his/her responses.) If the student is standing beside the teacher's desk waiting while the teacher corrects the worksheet, or the student is walking up to the teacher's desk to pick up the corrected worksheet, then not engaged-interim (learner move) is coded, with no instructor move at that moment.

One other situation that provides examples of academic feedback is that where students take turns orally stating the answers to homework problems while the other students listen and correct their own papers. The learner move would be engaged-written when the target student is listening and marking his answers right or wrong. It would be engaged-oral when the target student is orally stating the answer to a problem. Academic feedback

(instructor move) from the student (source) to the group (focus) would be coded when another student is giving the answer to a problem. However, if the other student gives an incorrect answer and the teacher corrects him/her, then academic feedback (instructor move) from the teacher (source) to the group (focus) is coded. If the target student is orally stating the answer to a problem, then academic feedback (instructor move) from the teacher (source) to the target student (focus) is coded. In this case the teacher is providing implicit feedback by saying nothing (indicating that the target student is correct) or explicit feedback by correcting the target student's error.

The academic question code is used when the teacher is asking the student to provide a written or oral answer to a mathematics problem.

Academic question is also coded for written questions if the teacher provides them directly on a problem-by-problem basis. That is, when the teacher uses flash cards to quiz a student, then academic question is coded for the written questions of the flash cards. However, when the teacher hands the student a worksheet of problems, no instructor move is coded.

Note that if the teacher uses flash cards with the target student, teacher is coded as the source of the academic question and target is coded as the focus (the learner move is engaged-oral). If the flash cards are shown to the entire class, then group is coded as the focus. If the flash cards are directed to another student so that the target student hears the other student's answer but does not know what the flash card question is, then no academic question is coded.

The explanation code is used for instructional explanations that are provided to satisfy a clear and immediate student need for help with a substantive mathematics problem. Explanation will usually be directed

toward the resolution of confusion or a misunderstanding that is evidenced by the student's inability to perform a task. In many cases an explanation instructor move will be initiated by a student question. Usually this instructor move will be directed toward the individual student for whom the need exists. However, an explanation instructor move can be directed toward an entire class. This might occur when the teacher observes that the entire class is having difficulty performing a particular task. The teacher's efforts to explain that task to the class would therefore be coded as explanation.

The observer should be aware that an explanation can take the interrogatory form, as when the instructor uses rhetorical questions as an explanatory device.

Note also that when the student has an immediate need for an explanation of directions to a mathematics task, then that explanation would be coded as structure-direct rather than explanation. The explanation code must be used for explanations of the substantive content of a mathematics task.

The explanation code is also used for instructional explanations that do not pertain to an immediate academic need of the target student. This will often take the form of a lecture. Explanations may be directed toward something that the teacher sees as a long-term need of the student.

If some explanation is mixed with structuring and directing, then the explanation is coded, because the substantive content takes priority. The observer should take care, however, not to confuse the explanation of substantive content with statements of instructional objectives (structuring) or explanations of the procedures for completing academic tasks (directions).

The structure-direct code is used for statements of goals or objectives (structure) and the provision of instructions or directions (direct). As with the other instructor moves, this must pertain to the mathematics task coded for the same event. The structure-direct code is used only for non-substantive instructional moves, directed toward student learning of the goals or directions for a task, rather than the mathematics substance of the task. Hence, structure-direct instructor moves are related to learning outcomes in mathematics only indirectly, through their facilitation of subsequent student learning behaviors.

As discussed above, if a structure-direct move is mixed with a substantive explanation, then the explanation is coded. However, any teacher observation, feedback, question, or explanation that pertains only to the structure or directions of a mathematics task is coded as structure-direct.

It has been pointed out earlier in this manual that a variety of mathematics content categories will sometimes pertain to the same structuring and directing. In these cases, mathematics related is coded for the content of the event.

Note that no instructional move is coded while the teacher collects or passes out papers, or writes on the board (unless the teacher provides simultaneous oral instruction). These are interim activities, not structuring or directing. Interim activities are not coded for the teacher.

The task engagement feedback codes (positive or negative) is used for the instructor's moves to control inappropriate student task engagement (off task behavior) or to praise positive student task engagement. This code is never used for teacher feedback relating to the student's academic responses (correct or incorrect). This is coded academic feedback, as discussed above.

The task engagement feedback codes must be related to the mathematics content coded for the same event (no instructor move is coded unless it is related to the content of the event for which it is coded). Therefore, if there is no mathematics content, then no task engagement feedback can be coded. As discussed earlier in this manual, most disciplinary instructor moves outside of any instructional activity will be coded as transition. Task engagement feedback within instructional activities other than mathematics will be coded as other instruction.

The task engagement feedback codes will generally be used during reprimands for the student's lack of engagement or praise for the student's engagement. Task engagement feedback can also take the form of directives pertaining to student engagement. For example, the teacher might tell all the students to put their heads down because they have been excessively noisy. Note that the task engagement feedback, negative would be coded for the entire period during which the students are instructed to keep their heads down. Task engagement feedback, negative, is considered the implicit instructor move throughout such a disciplinary activity.

Task engagement feedback is not coded for a target student to whom it does not pertain. Therefore, if the teacher reprimands a student other than the target student, then no instructor move is coded for the target student. The target student is coded as not engaged-off task if he/she looks up from the mathematics task to listen while the teacher disciplines another student. However, if the teacher tells all the students to put their heads down because they have been too noisy, but the observer is aware that the target student has been working quietly, then this task engagement feedback, negative, clearly doesn not apply to the target student even though he/she must attend to and obey that feedback. No instructor

move is coded because the task engagement feedback is not directed toward the target student, insofar as the teacher's concern is the students who have been noisy (the teacher is simply unable to identify and isolate each of those students). The learner move that is coded in this case is not engaged-interim, because the student is essentially waiting for the teacher to deal with the disruptive students in the class. This interaction between the teacher and the disruptive students has caused the target student's disengagement from the mathematics task.

As discussed previously, task engagement feedback is an exceptional instructor move in that the learner move to be coded with it is not the ongoing learner move of the moment. Rather, the learner move that precipitated the task engagement feedback is coded.

Two unusual examples of task engagement feedback require discussion. The first example involves a group question and answer activity where the teacher has asked a question and the target student answers out or turn. The teacher there upon reprimands the target student for answering out of turn. In this case, academic question (instructor move) and engaged-oral (earner move) are coded, rather than task engagement feedback, negative (instructor move) and not engaged-off task (learner move for answering out of turn). Each pair of moves, both instructor and learner, are involved in the interaction. However, the question and oral answer are coded because the student engagement in substantive academic content is given priority for coding over the student disengagement. (Ironically, both engagement and disengagement are the same student behavior in this example.)

The second example involves the situation where the teacher asks the target student for the answer to a problem and the student replies that he/she has not completed the problem. (The problem might be part of a

homework or an in-class assignment.) If the teacher reprimands the student for not completing the task, then this is coded as task engagement feedback, negative, from the teacher (source) to the target student (focus). The learner move would be "not engaged-off task" because this represents the behavior that caused the task engagement feedback. (That is, the student was not engaged-off task when he/she did not do the work.)

In the same example, however, the teacher might make no comment regarding the student's failure to complete the assignment. Instead, the teacher might simply move on to the next student, asking for the answer to the problem that the target student did not complete. In this case, no instructor moves is coded. However, the target student is still coded as not engaged-off task. This procedure is followed so that the learner moves in the two cases are coded in the same way. (The learner move is the statement that the assigned work was not completed.)

This second example, where the student cannot answer a question because he/she did not complete an assignment, should be distinguished from the case where a student cannot answer a question simply because he/she does not know the answer (as when there was no relevant assignment). If the teacher asks the target student an academic question and the target student states that he/she does not know the answer, then engaged-oral is coded as the learner move. Academic question would be the instructor move, unless the teacher follows up with an explanation of the correct answer, in which case the instructor move would be explanation.

Source of Instructor Moves. The source of an instructor move is coded as teacher, other adult, student, or curriculum. In each case, the source coded for an instructor move indicates who (or what) provides the target student with the instructional move coded for the same event.

Teacher is coded for the source of any instructional move by the person who is in charge of the class. This would generally refer to certificated personnel. (It does not necessarily refer to the same teacher who is coded in the teacher identification area of the coding sheet.) A student teacher's instructor moves would be coded for a teacher source if that student teacher is placed in charge of the class. Generally, only one person can be in charge of a class at a time. However, in some team teaching situations, two persons could be in charge of the same group of students at the same time.

Several examples of the coding of the teacher source are presented in the preceding discussion of instructor moves. However, one instance warrants reiteration. During the time that a student is examing the teacher's written corrections of that student's work, academic feedback is coded as the instructor move, teacher is coded as the source of that move, and the target student is coded as the focus. Therefore, it is possible for the teacher to be the source of an instructor move at a moment when he/she is not present (but his/her written feedback is present).

The other adult source code is used in the same way as the teacher source code, except that other adult refers to any adult who is not in charge of the class (and provides an instructor move). This might refer to a student teacher, a teacher's aide, or a parent volunteer. The other adult code will usually refer to non-certificated personnel.

The student source code is used for instructor moves provided to the target student by another student. The most obvious example of this is the tutoring situation, where another student is acting as the instructor for the target student. However, the examples discussed in the preceding section on instructor moves illustrate several cases where a student would be coded as the source of an instructor move even though the teacher is leading the instructional activity. An example is the situation where another student has been asked by the teacher to give the answer to a mathematics problem. This is coded as academic feedback from the other student (source) to the group (focus). It should be noted that when the target student is providing instruction to one or more other students, the target student's instructor move is not coded as an instructor move for the target. That is, a target student cannot be the source of his/her own instructor move.

Focus of Instructor Move. The focus of an instructor move is coded as a means of providing a general indication of the extent to which an instructor move is designed for the particular needs of the target student. Focus also provides some indication of the probable level of student attention to the instructor move. That is, when the target student is the focus of an instructor move, that move will generally be designed according to the particular needs of that student at that time. In addition, the student is likely to attend relatively carefully to an instructor move that is directed to him/her in particular. An instructor move with a group focus, however, will usually be designed for the group as a whole, not the target student per se. In addition, the target student may not concentrate as intently when the instructor move applies to the entire group. For example, when the teacher asks an academic question directed to an entire group, then it is unlikely that the teacher had the target student in mind when formulating the question. In addition, the target student knows that another student will probably answer the question, so that the target student need not be too concerned with determining the correct answer.

The target code for focus is used when an instructor move is directed specifically to the individual target student being observed. The preceding sections on instructor moves and sources of instructor moves provide numerous examples for the coding of the target focus. Perhaps the narrowest distinction between target and group focus is illustrated by the contrast between the written corrections of a student worksheet provided by the teacher and the written list of the correct worksheet answers posted by the teacher for the entire class. The academic feedback in the first case is designed according to the actual responses of the target student in particular, so the target student is coded as the focus. The group is coded as the focus in the second case because the list of correct answers applies equally to any of the students.

The group code for focus is used when an instructor move is directed to the group of the target student. Several examples of coding the group focus are provided in the preceding sections. It is important to note that an instructor move directed toward the target student's group is coded only if it is relevant to the target student. Therefore, if the target student ignores a teacher's explanation to the class, continuing instead to work on a seatwork task (an engaged learner move), then the instructor move (explanation) is not coded. The target student, in this example, must be coded as engaged but cannot be coded as engaged in an instructor move that he/she ignores, even if that instructor move is directed to his/her group.

Learner move-instructor move sequences. As discussed at several points in this manual, it is essential to this observation system that all the codes within a single event be meaningfully interrelated. It is particularly important to code instructor moves that are meaningfully related to the learner move of the same event. Therefore, if the student is coded as not engaged, then an instructor move coded for the same event must be ignored by the student (not engaged). As discussed previously, task engagement feedback moves are coded according to a different procedure, where the learner move represents that student behavior to which the task engagement feedback is directed.

The importance of this procedure (coding learner and instructor moves that are meaningfully interrelated within the same event) lies in the fact that instructional interaction between the student and the teacher can be represented with this procedure. Thus, a learner move-instructor move sequence is implied when both moves are coded within the same event. If engaged-oral is coded with academic feedback, the the implied sequence is a student oral response followed by teacher feedback. If engaged-covert is coded with academic feedback, then the feedback (to which the student is listening silently) must pertain to student responses that occurred previously, because a covert student move would not enable the teacher to provide direct feedback. The engaged-covert and academic feedback sequence would occur when the student is examining a corrected paper returned by the teacher.

In many cases a learner-instructor sequence of interrelated moves will involve several categories of learner moves and/or several categories of instructor moves. When all of these moves are directly interrelated, then it is inappropriate to simply code the moves that occur at the moment sampled for observation. Rather,

the coding should represent the learner-instructor interaction that is ongoing at the moment sampled. This is accomplished by coding the most important learner and instructor moves from the sequence, as determined according to the hierarchical priorities described below. Note that when two moves are of equal importance in the hierarchy and both occur within the same sequence, then the move that is closer to the moment sampled is the one to be coded.

The hierarchy for learner moves gives the highest priority to engaged-written and engaged-oral, where these two moves are given equal priority. Next in the hierarchy is engaged-covert. Lowest in the learner move hierarchy are the two not engaged moves (interim and off task), each of which is equal in the hierarchy. (Note that specific examples have been discussed previously, illustrating which not engaged move should be coded in particular situations. See the discussions of the two not engaged learner moves.)

An an example of the application of the learner move hierarchy, consider the sequence where the target student answers a question orally and then listens to the teacher's academic feedback. Both engaged-oral and engaged-covert have occurred in this sequence. Engaged-oral is coded even if the student is listening at the moment sampled, because the student's oral response was part of the same sequence and is of a higher priority than the listening.

The hierarchy of instructor moves gives the highest priority to explanation. Below explanation are academic feedback and academic question, these two moves being given equal priority. Lowest in the hierarchy is structure-direct. Note that task engagement feddback, positive or negative, is not part of this hierarchy. These instructor moves are not considered to be sequentially related to the other instructor moves. Therefore, task engagement feedback is only coded when it occurs at the moment sampled. (See the

examples for task engagement feedback in the preceding discussion.)

A common example of an instructional sequence to which this hierarchy must be applied is that where the teacher observes the academic response of a target student, recognize an error, asks a question pertaining to that error, provides feedback after the student answers the question, and gives an explanation of the problem because the student does not understand it. This is a long sequence involving several instructor moves. However, the instructor move coded for any moment sampled within this sequence would be explanation, the highest priority move in the sequence.

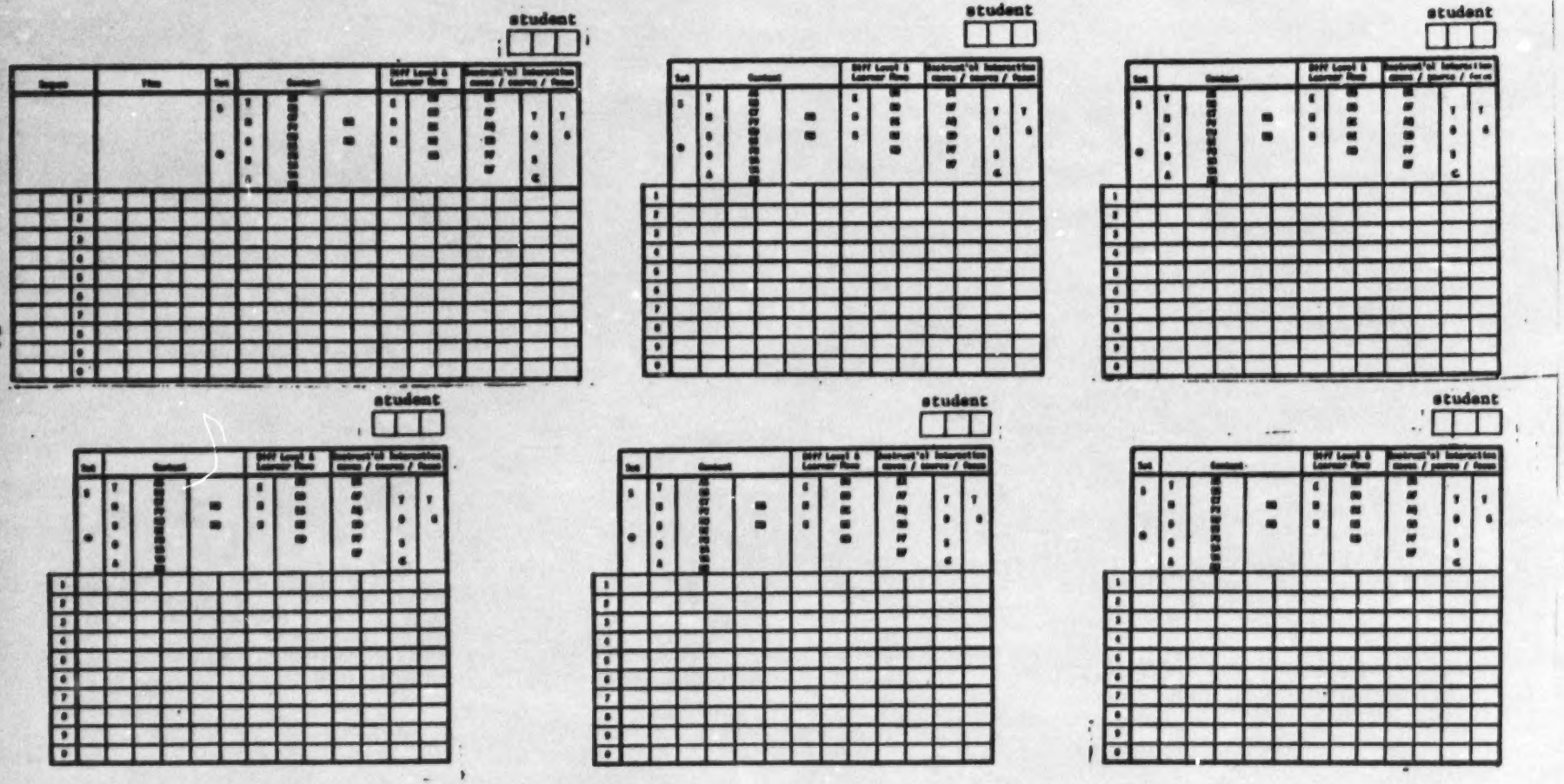
The observer should be aware that this procedure may require observation of a sequence beyond the moment sampled in order to identify the highest priority move of the sequence. However, in the example above, the observer would know that explanation should be coded as soon as that instructor move occurs, because no instructor move of a higher priority is possible. If the same sequence is sampled again on the next cycle, then the observer will already know that the instructor move coded for the sequence is explanation.

Coding Form

The procedures described in this manual are designed to be used with a coding form whereon the observer writes letter-codes (see Figure 1). Note that this form allows for the coding of ten events for each of six students on a sheet. The form also allows for the coding of the numerical sequence of each event and the starting time for each series of events (one per student).

Sample Observation Coding Form

TEACHER | GRADE | OBSERVER | DATE | PAGE NO.



APPENDIX F:

INFORMATION SHEET FOR PARTICIPATING TEACHERS

FAR WEST LABORATORY
FOR EDUCATIONAL RESEARCH AND DEVELOPMENT

January 28, 1980

TO: PARTICIPATING TEACHERS

Welcome to the Special Study of Academic Learning Time!
The purpose of this letter is to give you some general information about the project and acquaint you with the study procedures.

Purpose of the Study

- To observe mainstreamed and regular students in mathematics.
- To examine the variables in the learning environment and to relate these variables to student engaged learning time.

Classroom Observation Schedule

One fieldworker will observe in your classroom during math period, once a week, over a six-week period. Due to holidays and teacher absence, there is a possibility that the observation period will be extended by one or two weeks. On occasion, for purposes of reliability checks, two fieldworkers will be paired for an observation period. Every attempt will be made to honor your preferred days for observation, however, in view of the number of schools and classrooms to be scheduled, we ask for some flexibility on your part. Prior to the first observation, please tell your students that someone will be observing math work and that this person will be busy and won't have time to talk during class time.

Observation Procedures

The observers will arrive shortly before math instruction begins. They will need your assistance to unobtrusively identify the six target students on the first visit. Please do this without specifying those students who are mainstreamed, in order to reduce observer bias. The observers will be coding the learner moves, content area and difficulty level on five minute cycles. Consequently, they will not be available to answer questions or provide tutorial help for students. The observers will be as unobtrusive as possible. However, they will need to move around the classroom, examine written work, and occasionally ask questions.

Stipend

You will receive an $80.00 honorarium for your participation in the study. Payment will be made in June, 1980.

For further information, please contact:

Carol Rice or Susie Thum
(415) 565-3135

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